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ABSTRACT

This document is the second curriculum development project of the Connecticut Geographic Alliance. The Alliance focuses on equipping teachers for more effective geographic instruction by providing leadership training so teachers can conduct workshops in local districts, and offering institutes for teachers that focus on important geographic issues, and developing materials for instructional use. This document discusses the five themes of geography (place, location, region, human/environment relationships, and movement) as they fit into three roles that geography fills: (1) geography as world awareness; (2) geography as environmental relationships, or understanding how the ecosystem works; and (3) geography as a perspective, in which one examines current and past events in geographic context. Five geographic niches in the K-12 curriculum are listed. Learning activities for the classroom are divided into sections. The first is centered on disasters. This section begins with natural disasters, moves on to a simulation on the movement of refugees, and ends with manmade disasters. The second section is on ecologically fragile environments. It includes a case study and simulation on desertification, a section and a role play on rainforests, and a section on ways to meet current needs. The third section is about human impact on the environment. Lessons in this section deal with the ecological dangers of monoculture, tourism, biodiversity, case studies in values, culture, and ethics in preserving biodiversity, and selection of nuclear waste disposal sites. The document includes bibliographies, handouts, maps, an index of lesson plans by grade levels, and geothemes. (DK)

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Teacher's Resource Guide on

Geography and the Environment: International Perspectives

SO 023 798

Connecticut Geographic Alliance - 1993

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Teacher's Resource Guide on

Geography and the Environment: International Perspectives

Edited by Edward Lang and Caryn White

"I pledge my commitment, and that of the National Geographic Society, to revitalize geography education in America's schools."

Gilbert M. Grosvenor
President and Chairman
National Geographic Society

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FOREWORD

This *Resource Guide* is the second curriculum development project of the Connecticut Geographic Alliance. The Alliance is a part of the National Geographic Society's Alliance Network. Aided by a $50,000 grant from the Society's Education Foundation for each of three years (1992-1995), the Alliance has developed a three-year program of geography education activities. Alliance activities funds will be matched each year by state funds as well as local individual, foundation and corporate funds.

Connecticut Geographic Alliance is an organization of educators and other citizens who are concerned about improving opportunities for geographic education in Connecticut's schools. The Alliance focuses on equipping teachers for more effective geographic instruction by providing leadership training so teachers can conduct workshops in local districts, offering workshops/institutes for teachers that focus on important geographic issues, and developing materials for instructional use. Current membership includes teachers and administrators from more than half of Connecticut's towns, faculty from the state's four academic geography programs (University of Connecticut, Central Connecticut State University, Southern Connecticut State University and Manchester Community College), and concerned citizens in real estate and development, environmental agencies and international business.

Judith W. Meyer, professor of geography and Associate Provost of Academic Affairs at the University of Connecticut, and Daniel W. Gregg, social studies consultant for the Bureau of Curriculum and Instruction at the Connecticut State Department of Education, are co-coordinators of the Alliance. They are assisted by Sheila Spellacy, a teacher at East Hartford Middle School, who serves as inservice program coordinator, and an advisory board representing teachers, faculty, administrators, school board members, and members drawn from business, local government and the community.

ACKNOWLEDGEMENTS

This *Teacher's Resource Guide on Geography and the Environment: International Perspectives* grew out of a weekend workshop retreat at the Institute of World Affairs in Salisbury, Connecticut, and was written to assist teachers in developing and implementing curriculum on international and environmental issues in Connecticut's classrooms. As was its predecessor, the *Teacher's Resource Guide on Substance Abuse Prevention and Geography,* this guide also was a direct response to meeting the goal of using the discipline of geography to address global environmental issues.

This resource guide was developed and edited from draft lesson plans written by the participants of the weekend workshop "Geography and the Environment: International Perspectives", by Connecticut Geographic Alliance Steering Committee and Advisory Board Members:

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In addition, the Connecticut Geographic Alliance is indebted to the National Geographic Society for use of lessons and maps from *Directions in Geography;* and to the National Council for Geographic Education and the Department of Education at Brigham and Young University for the world outline map.

A special thanks to individuals who reviewed this resource guide for environmental content and pedagogy. They included:

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This resource guide was developed by a grant from the Connecticut State Department of Education and the Barnes Foundation.

PREFACE

The Connecticut Geographic Alliance supports projects that bring a geographic perspective to curriculum priorities of Connecticut schools. For this reason, the Alliance is pleased to offer this resource guide as one way of supporting the international environmental issues curriculum offered by Connecticut schools.

In addition, the Alliance offers leadership training so that teachers can conduct workshops in local districts; provides state and regional workshops/institutes for teachers on important geographic issues; and develops materials for instructional use. Teacher consultants from Connecticut's schools (K-12) and faculty from the state's college geography departments are prepared to offer inservice programs for teachers. Four options for inservice programming have been developed, each of which can meet school needs.

Full Day Workshop: Geography content, discussion of classroom applications of content, demonstration lessons and teaching strategies. Personnel: Teacher consultant and geography faculty person or teacher consultant with content expertise.

One-Half Day Workshop: Shorter version of full day workshop, with combination of content and teaching strategies.

Awareness Workshops: One-half day or afterschool session with teacher consultant who does an introduction to the Five Themes of Geography, a demonstration lesson and discusses teaching strategies.

Afterschool Series: Two-hour sessions, alternating between content presentations and teaching strategies and demonstration lessons. Personnel: Teacher consultant and geography faculty person.

For additional information on how to access these options, contact the Connecticut Geographic Alliance, Geography Department, U-148, University of Connecticut, Storrs, CT 06269-2148 (486-0374), or Sheila Spellacy, inservice coordinator, (235-6706), to arrange a program that fits your needs.

OVERVIEW

FIVE THEMES FOR THREE ROLES

Geography as World Awareness
KNOW ABOUT THE WORLD

Place	Knowing characteristics of places and the people who live there.
Location	Knowing where places are with respect to other places.
Region	Generalizing about human and physical characteristics of areas of the world.
Human/Environment Relationships	Understanding how people in different cultures use, respond to and change the environment.
Movement	Understanding how the world is interconnected through migration, communication, and exchange.

Geography as Environmental Relationships
UNDERSTAND HOW THE ECOSYSTEM WORKS

Place and Region	Knowing characteristics of different environments.
Location	Understanding how different locations result in different ecosystems.
Region	Know the world's major biomes.
Human/Environment Relationships	Understanding how people use, are influenced by, and change the world ecosystem.
Movement	Understanding how movement connects the world's ecosystem.

Geography as a Perspective
EXAMINE CURRENT AND PAST EVENTS IN GEOGRAPHIC CONTEXT

Place and Region	Who and What? Investigating the characteristics of places, regions, and the people who live there.
Location	Are Where? Exploring the significance of location and relative location.
Human/Environment Relationships and Movement	Why? Analyzing cause.
Human/Environment Relationships and Movement	So What? Predicting consequences.

GEOGRAPHY AND ENVIRONMENTAL EDUCATION

1. Environmental Education will be the next major source of federal education dollars. It is unlikely that an environmental education will be added to a tight K-12 program as a separate curriculum. Environmental education will be integrated either into science, or the geographic portions of the social science curriculum, or both.

2. Geography has several clear advantages as a vehicle for environmental education in our society.

- It bridges the sciences and social sciences as do most environmental problems.
- It fits in the curriculum at a variety of levels.
- It examines issues in local, regional, national and global contexts.
- It is one of 5 core disciplines in the Nation's Education Goals.
- Human/Environmental relationships has been one of our longest traditions, and is one of 5 themes of Geographic Education.
- Environmental decisions will often be location decisions.
- The Alliance Network is one of the country's largest groups of trained, experienced in-service presenters.

3. Geography has three primary roles in the K-12 system: World Awareness, Environmental Understanding, and Perspectives on Present and Past Events. Environmental topics have a place in all three roles. The five themes are a helpful framework for accomplishing each of the three roles.

4. Geography has 5 more or less clearly defined niches in the K-12 curriculum. The major roles for geographic education changes with grade level. Geography as environmental education will be strongest in upper elementary grades in a U.S. context and in middle school and high school in a global context.

5. Basic principles of environmental education can be taught effectively within the 5 themes instructional framework.

FIVE GEOGRAPHIC NICHES IN THE K-12 CURRICULUM

Grade Level	Common Geographic Components in the Curriculum	Typical Course Titles	Primary Role for Geography
K-3	Geographic awareness activities linked with children's experiences.	School, family, neighborhood, community	Enthusiasm for learning about the world.
3-6	Geography units in interdisciplinary social studies courses.	Communities, states, U.S., comparative religions, Western Hemisphere	Understanding the environment and human/environment relationships.
7-9	A one- or two-year world geography course.	World regional geography, global geography	Developing world awareness.
8-11	Geographic topics in American and World History.	American History World History	Seeing historical events in geographic context.
11-12	Global issues.	Global Issues, Global Geography, World Problems	Using a geographic perspective on world events and global problems.

GEOGRAPHY AND ECOLOGY
Rules Governing How the World Works

PLACE

1. Matter is neither created nor destroyed, but merely changes form.

2. All life and all forms of food begin with sunlight and green plants.

3. Energy is neither created nor destroyed, but merely changes form.

LOCATION

4. Because of cosmic factors, matter, energy and food are distributed unequally over the earth.

REGION

5. The existence, abundance and distribution of any organism is determined by the least available essential resource or interacting organism, creating different ecosystems.

MOVEMENT

6. Places are connected with other places in regional and global ecosystems.

HUMAN-ENVIRONMENT RELATIONSHIPS

7. Total Human Environmental Impact = Population x Consumption per person x Impact per Unit Consumed

8. In looking at our human environmental impact, we face four major dilemmas:

   a. The Growth Dilemma
   b. The Distribution Dilemma
   c. The Control Dilemma
   d. The Work Roles Dilemma

9. To exist is to pollute. We can only choose what kind, and where. Many environmental decisions will be location decisions.

Source:
NCGE / Draft of Curriculum Recommendations

GEOGRAPHY: THE FIVE THEMES

In 1984, the Association of American Geographers and the National Council for Geographic Education published *Guidelines for Geographic Education: Elementary and Secondary Schools*. The booklet introduces the five themes:

1. **LOCATION:** Position on the Earth's Surface
2. **PLACE:** Physical and Human Characteristics
3. **HUMAN/ENVIRONMENT INTERACTIONS:** Shaping the Landscape
4. **MOVEMENT:** Humans Interacting on the Earth
5. **REGIONS:** How They Form and Change

LOCATION: Position on the Earth's Surface

This is the most basic theme and answers the question: Where is it?

Absolute Location: The exact, or absolute position of something on the earth's surface can be identified by using a grid system of latitude and longitude. Without absolute location, we could not navigate or describe where something is. Two examples:

KUWAIT: The Kuwaiti oil field fires constitute a major man-made disaster with long-term ecological impact. Kuwait city, the capital of Kuwait, is located at 29 15' N - 48 00' E.

SOUTHERN FLORIDA suffered enormous human, economic, and ecological damage from Hurricane Andrew, the costliest storm in U.S. history. Miami, the largest city affected by the storm, is located at 25 45' N - 80 15' W.

Relative Location: Knowledge of locations is a key aspect of understanding interdependence on local, regional, national, and global scales. Example:

The worst nuclear disaster in human history, the explosion at the power plant in Chernobyl, Ukraine (in the former Soviet Union), caused intense local damage and widespread radioactive contamination. The location of the power plant, the prevailing weather patterns, the existing communication networks, and the local political situation affected the spread of the contamination, the ability of the army to respond, and the release of information to the rest of the world.

PLACE: Physical and Human Characteristics

All places on the Earth have distinctive tangible and intangible characteristics that give them meaning and character and distinguish them from other places.

Physical Characteristics: The forces of nature that produce landforms, water bodies, climate, soils, natural vegetation and animal life.

Human Characteristics: Places may vary in their population composition -- settlement patterns, economic and recreational activities, religious tenets of the people, and economic, social and political organizations.

Consider the following examples:

The Sahel in Northern Africa is an arid to semi-arid, sparsely populated region of sparse vegetation receiving 4-20 inches of rainfall annually. It is subject to cyclic droughts, locust plagues and is highly susceptible to desertification. Its inhabitants survive through subsistence farming and herding.

Kuwait is located at the northern end of the Persian Gulf (known as the Arabian Gulf in Kuwait and Saudi Arabia) and the northeastern edge of the Arabian Peninsula. Except for the bustling, modern city of Kuwait, the

landscape is a sculpted, barren desert, broken by oases, patches of green irrigated fields, oil fields and criss-crossed by modern highways. Until the discovery of Kuwait's enormous oil reserves and the rapid accumulation of wealth from exploiting these reserves, the land was inhabited by nomadic tribes and their herds of sheep, goats and camels. Now young Kuwaitis drive trucks and cars, attend world class universities, and look to a future full of material comforts their grandfathers could not have imagined. The effect these changes have had upon Kuwait's strong Islamic tradition is still being debated.

HUMAN/ENVIRONMENT INTERACTIONS: Shaping the Landscape

Theme 2 provides keys to understanding the interrelationships between people and their environment. Theme 3 addresses the question: What is the relationship between humans and the environment?

Humans depend on their natural environment which they have modified over the centuries and adapted to as necessary. These examples illustrate Theme 3:

Farmers in Sri Lanka clear and terrace tracts of land to plant high yield cash crops, often in single-variety monocultures. Clear cutting virgin lands destroys the natural vegetation and variety. Replacing it with single variety monocultures greatly increases the potential for widespread disaster.

Between 1969 and 1975, BR-364 (the Trans-Amazon Highway, funded by the World Bank and mostly U.S. funds) cut through the rainforests of Brazil. Bulldozers felled the trees, the road was laid, and thousands of families seeking a new life travelled the road, cut and burned large areas of trees and began to farm the land.

MOVEMENT: Humans Interacting on the Earth

Movement of people, goods and ideas -- relationships between people in different places constitutes the fourth theme. It addresses the question: How and why are places related to one another? The two examples of this theme follow.

Both natural and man-made disasters are accompanied by the large scale movement of refugees. In the former Yugoslavia, ethnic warfare, a man-made disaster, has killed tens of thousands and uprooted more than 1.5 million from their homes. Many of these refugees have migrated to Western Europe, while others have moved to other areas of the former Yugoslavia to escape the violence.

The fingernail-sized zebra mussel, which originally came from the Black Sea area of Asia, was transported in ballast water of cargo ships coming to load U.S. grain from ports along the Great Lakes. The mussels have spread south and east from the Great Lakes along the New York State Barge Canal and into the Hudson River and are poised to move into Connecticut.

REGIONS: How They Form and Change

A region is a basic unit of geographic study. Regions are areas that have unifying characteristics. They are convenient and manageable for organizing our knowledge of the world. They help us answer the questions: How are areas similar -- and how are they different?

The Sahel covers more than a half dozen countries of northern Africa. It is characterized by low rainfall, scrub vegetation, sparse population and cyclic drought. It is located immediately south of the Sahara.

Unlike man-made disasters, natural disasters tend to occur in regions where the climatic or geological conditions support the occurrence of such phenomena as hurricanes, tornadoes, and earthquakes. While tornadoes occur in a variety of locations, the central plains of the U.S. experience the greatest frequency of tornadoes. The "ring of fire" around the Pacific is so named because of the intensity of volcanic and seismic activity found along its perimeter.

GEOGRAPHIC SKILLS

In addition to the five themes, *Guidelines for Geographic Education* also outlines geographic skills that students must acquire if they are to become adept geographic thinkers and learners. These skills are grouped under five headings:

1. Asking geographic questions
2. Acquiring geographic information
3. Presenting geographic information
4. Analyzing geographic information
5. Developing and testing geographic generalizations

Throughout the lessons in this project, students are given the opportunity to increase these skills.

1. **Asking geographic questions** --
   a. Where is each nation located?
   b. What is the total population?
   c. Is the nation developed or under-developed?
   d. Is the nation industrialized or agricultural?

2. **Acquiring geographic information** --
   a. Use atlases and other sources of information, e.g., newspapers and government sources to gain information.
   b. Use information on charts and graphs to expand and/or simplify data.

3. **Presenting geographic information** --
   By using the data on this chart, students could con struct a thematic map. It might become the basis for further research, such as a written or oral report on the factors in one nation compared to the United States. Students should be encouraged to use a variety of materials when presenting infor mation.

4. **Analyzing geographic information** --
   To analyze geographic information, students must be able to read maps, tables and graphs. To gain map-reading skills, students must learn to preview a map by inspecting the title, decoding the symbols, finding the directions, and examining the scale. They must learn to describe relationships and make comparisons and inferences. Several maps are included in this project; trade routes can be analyzed in this manner. Direction, distance, and method of transport are other possible topics for students to analyze.

5. **Developing and testing geographic generalizations** --
   Students must learn to make inferences based on material presented in maps, tables and graphs. Pre-view the data, analyze the data, develop a hypothesis, and then gather additional information to support or reject the hypothesis.

Solutions to many of today's environmental problems are often highly complex. Local decision-makers must take into account issues such as location, topography, popula-tion size, culture, political and monetary policy, and the availability of technology and resources. As we face the more awesome task of solving environmental issues on a global scale, our success will depend upon not only these issues, but in understanding each other and the world around us.

As students of geography and the environment, locating features on the surface of the earth is only the beginning. Each location can be described and defined by sets of physical and human characteristics, and students must learn to recognize what makes one region similar or different from another.

To understand the environment from a physical perspec-tive, students will need to understand concepts such as: plate tectonics, ocean currents, and climate patterns. These will help answer the question "Why there?" when a natural disaster occurs, or "Why not there?" when looking at low population densities in desert regions of the world.

Different cultures and belief systems lead to different types of societies where resources are defined differently and land usage varies. Understanding these human characteristics is vital to the student in comprehending humankind's impact on the environment. Whether popu-lations are located in dense urban centers or rural agricul-tural villages, they consume resources and generate waste and pollution.

As lessons focus on different geographic regions, students will need to recognize that solutions to environmental problems are not universal. Each country has it's own agenda and set of priorities. In countries suffering from drought and starvation, food is the priority, and agricul-tural techniques often lead to further environmental degradation. Wealthier nations "clean up" their own backyards, while at the same time, consuming more than their share of the earth's natural resources.

Finally, as students look to the future, they need to understand the implications of a rapidly growing world population and what it may mean for the carrying capacity of the earth. In many regions of the world we have already witnessed that man and nature can render the environ-ment incapable of sustaining large numbers of people. Students must begin to hypothesize the answers to ques-tions such as: What will happen? What could be done? What should be done? What can be done? Will it work here? Or will it work there?

Disasters

Natural Disasters ..... page 8
Annea Rosenberg and Bill Mishico

Simulation: Movement of Refugees ..... page 11
Annea Rosenberg and Bill Mishico

Man-Made Disasters ..... page 17
John Stedman

NATURAL DISASTERS

Preview of Main Ideas

In this lesson, students are introduced to natural disasters and the impact such disasters have upon a region. As with man-made disasters, natural disasters cause human and economic loss and displacement. In this lesson, students will develop a working definition for natural disasters and will identify six types. They will analyze several recent or historical disasters and locate them on a world map. (Teachers may want to follow this lesson with the simulation activity found in "Refugee Movement Simulation.")

Connections with the Curriculum

Social Studies: current events
Geography: locating regions using an atlas
Science: natural sciences, study of natural disasters such as volcanoes, tornadoes, earthquakes; study of weather
English: research paper on issues above; debate current issues, i.e. Should the U.S. airlift supplies into Serbia?

Teaching Level: Grades 7-12
Geographic Themes: Location, Place, Human/Environment Interactions, Movement, Regions

Materials

Reference Map A - World Map (pg. 80)
Handout #1 - "Geothemes"
Atlases and Almanacs
Newspaper and magazine articles on recent natural disasters
(including *National Geographic's* "Andrew Aftermath", April 1993)
Large blackboard or large sheets of newsprint
Markers, pencils, tape
Optional audio-visual materials:
Laser disks "Our Environment," "Hugo"
Video on natural disasters (research titles of several videos and sources)

Objectives

Students are expected to:

- Define and identify six natural disasters (i.e. hurricane, tornado, earthquake, volcanic eruption, flood, drought).
- Locate on a map regions prone to specific natural disasters.
- Examine natural disasters in terms of geothemes and provide examples for each theme.
- Discuss issues relating to natural disasters and their effects on people and on the environment.

Suggestions for Teaching the Lesson

OPENING THE LESSON

Have students collect and read articles on various natural disasters, including "Andrew Aftermath", (*National Geographic*, April 1993) or show students clips from laser disks or clips from videos.

DEVELOPING THE LESSON

1. Have students brainstorm a definition for "natural disaster". Use large sheets of newsprint or the board to record student ideas. If you have done the lesson on "Man-Made Disasters", compare and contrast natural and man-made disasters.

2. Have class brainstorm elements that all natural disasters have in common. List these elements on board or

newsprint. Save for #4 below. These should include:

a. destruction of property - personal and community
b. death - individuals, families, people who supply necessary services
c. displacement of people (refugees)
d. mobilization of community, country, world - movement of people within disaster area, movement of aid
e. sense of community and cooperative spirit - individual and community values, shared experiences
f. creation of medical emergency - immediate, sanitation, spread of disease (long range)
g. loss of essentials for life - food, water, shelter
h. social chaos - riots, looting, imposition of martial law
i. interruption of communication, both external and internal
j. ability to recover - rebuilding, relocating

3. Discuss current or recent natural or national disasters. Have students name as many as they can think of. List them on the board or on large sheets of newsprint. Save for #4 below. (Some things the students should come up with include Hurricane Andrew, Hugo, earthquakes in Turkey, Iran, Mount Pinatubo.)

4. Divide students into groups and assign each group one of the disasters from #3 above. Give each group Reference Map A and Handout #1. Discuss "Geothemes" (see teachers' introduction). Provide articles, etc. on the disaster or have students go to the library to research the disaster. Each group should have a recorder and a reporter. Each group is to examine the disaster in terms of the elements the class came up with in #2 above and have the recorder write down what the group has researched on each element for the disaster. At the end of the activity, the reporter should report to the class what the group discovered.

CLOSING THE LESSON

Have students locate on a world map the sites of the disasters that they have researched. Have students use a different color pen or marker for each of the six types of natural disasters. Use the "Geothemes" (Handout #1) to discuss patterns for locations of natural disasters.

Some questions you might ask your students include:

Are there patterns for certain natural disasters?
Are there places where certain natural disasters never occur?
Why?

EXTENDING THE LESSON

Have students do "Refugee Movement Simulation".

By Annea Rosenberg and Bill Mishico, Ridgefield Junior High School

HANDOUT #1 - Natural Disasters

"*Geothemes*"

GEOTHEMES

Examine each type of natural disaster in terms of the five Geothemes.

The five themes are:

Location
Place
Human/Environmental Interaction
Movement
Region

The six categories of natural disasters are:

Flood
Drought
Volcanic Eruption
Earthquake
Hurricane
Tornado

SIMULATION: MOVEMENT OF REFUGEES

Preview of Main Ideas

Students will participate in an activity that simulates refugees displaced by natural or man-made disasters and could be used as an extension of either the lesson on "Natural Disasters" or the lesson on "Man-Made Disasters".

Connections With the Curriculum

Social Studies, Geography

Teaching Level: Grades 7-12
Geographic Themes: Location, Place, Human/Environment Interactions, Movement, Region

Materials

Pencils - represent food
Handout #1 - Countries and their Capitals (represents personal belongings)
Atlases - one per student
Floor space - represents group's homeland region
Tape - used to mark off space into three regions

The Simulation

You will assign students to a geography-related task that is NOT connected to the simulation except that it represents the tasks and patterns of everyday life which become disrupted by the natural disaster. The worksheet represents personal belongings, the pencils represent food, the task represents the routine of everyday life.

DIRECTIONS READ TO STUDENTS

You will be divided into three groups and given the task of locating in an atlas the capitals of nations of the world. Each student must complete his/her own worksheet. Each student must locate as many capitals as possible. The class, as a whole, must locate 90% of the capitals. Don't forget that you must include the page on which you have found each capital city.

Each group will be assigned an area of the room in which to work. No member of your group may leave the assigned area. You may not communicate with students in another section of the room in any way. After a period of time has passed, a natural disaster will strike. You will receive more direction at that time.

AFTER FIVE MINUTES, THE TEACHER SIGNALS TO THE STUDENTS TO STOP AND RAISES A PLACARD NAMING A DISASTER. AT THAT TIME, HE/SHE WILL SELECT A GROUP TO JOIN ONE OF THE REMAINING TWO. STUDENTS WILL MOVE TO THEIR NEW SECTION, TAKING ONLY THEIR WORKSHEETS. PENCILS (REPRESENTING FOOD) AND DESKS/CHAIRS AND ATLASES (REPRESENTING SOME BELONGINGS) MUST BE LEFT BEHIND. ONLY THE STUDENTS AND THEIR WORKSHEETS MOVE.

STUDENT DIRECTIONS:

A terrible flood (volcanic eruption, drought, etc.) has just occurred. Group 1 (or 2 or 3) must leave the homeland and travel to the region of Group 2 (or 1 or 3). You must leave your pencils, which represent your food, behind. You may only bring as many belongings as you can carry. This is your worksheet. When the new, larger group has formed, it too must remain in the taped area. No group members or furniture may leave the region. You must continue with your life in your new region and continue to work on your worksheets. Remember! Each student must complete his/her own sheet. Don't forget to include the number of the page on which you found each capital city.

AFTER FIVE MINUTES, THE TEACHER ONCE AGAIN SIGNALS FOR ATTENTION AND RAISES A PLACARD IDENTIFYING ANOTHER DISASTER. HE/SHE THEN MOVES THE SMALL GROUP TO THE AREA OCCUPIED BY THE LARGER ONE AND READS THE FOLLOWING:

STUDENT DIRECTIONS:

You have suffered a catastrophic volcanic eruption. Your home, food supply, and most of your belongings have been destroyed. Each member of your group must emigrate to the location of the other group. You may take only your worksheet.

Remember, each student must locate as many capitals as possible. As a class group, you must locate 90% of the capitals. **Don't forget to put the number of the page on which you found each capital city.** At the next signal, you must stop what you are doing. You will no longer be allowed to communicate with any other member of the class.

AFTER FIVE MORE MINUTES, STOP THE ACTIVITY.

DISCUSS THE ACTIVITY WITH THE STUDENTS IN TERMS OF GROUP DYNAMICS. USE THE FOLLOWING QUESTIONS AS A STARTING POINT.

1. How did you feel at the start of the activity?
2. Were you concerned only about yourself or about the entire group?
3. What was your major problem?
4. After your first displacement, how did you feel? What were your reactions when you were told you could not bring your desk or your pencil with you? Did you have any concerns about completing the assignment under these conditions?
5. How did your environment change when you moved?
6. How did the new conditions make you feel?
7. How did the citizens of your new region react to you?
8. In what ways, if any, did you have to change the way you worked on your assignment?
9. How did you feel when new people were added to your space?
10. How did you treat them? Did your status change?
11. How did your working conditions change?
12. Were people out for themselves, or did you work together cooperatively?
13. How were decisions made? Did anyone take a leadership role?

THE TEACHER CAN BRING THIS TO CLOSURE BY RELATING THE STUDENTS' EXPERIENCES WITH THOSE OF TRUE REFUGEES.

STUDENTS SHOULD BE GIVEN THE TERM "CARRYING CAPACITY" AND FROM THEIR EXPERIENCES, BE ABLE TO DEFINE AND DISCUSS ITS SIGNIFICANCE ON THE WORLD AND ITS PEOPLES.

By Annea Rosenberg and Bill Mishico, Ridgefield Junior High School

Handout #1 - Simulation: Movement of Refugees
COUNTRIES AND THEIR CAPITALS

COUNTRY	CAPITAL	PAGE NUMBER
China		
Australia		
Mexico		
Malaysia		
Brunei		
Canada		
United States		
Argentina		
Angola		
Saudi Arabia		
Israel		
New Zealand		
Bangladesh		
Peru		
Libya		
Sweden		
Bolivia		
Sri Lanka		
Venezuela		
Hungary		
Colombia		
Central African Rep.		
Germany		
Panama		
Chad		
Guatemala		
Haiti		
Ecuador		
Morocco		
Western Sahara		
Zaire		
South Africa		
Namibia		
Botswana		
Brazil		

COUNTRY	CAPITAL	PAGE NUMBER
Chile		
Nigeria		
Benin		
Bolivia		
Paraguay		
Honduras		
England		
Costa Rica		
Ireland		
Belize		
Scotland		
El Salvador		
Wales		
Sudan		
Iran		
Italy		
Yemen		
France		
Nicaragua		
Gabon		
Uruguay		
Suriname		
Holland		
Syria		
Somalia		
Guyana		
Egypt		
Belgium		
Libya		
Spain		
Algeria		
Oman		
Niger		
French Guiana		
Cuba		
Zambia		

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COUNTRY	CAPITAL	PAGE NUMBER
Mozambique		
Portugal		
Ethiopia		
Finland		
Zimbabwe		
Granada		
Tanzania		
Denmark		
Congo		
Japan		
Mauritania		
Liberia		
Ivory Coast		
Guinea		
Yugoslavia		
Togo		
Burma		
Sierra Leone		
Cameroon		
Hungary		
Thailand		
Kenya		
Poland		
Romania		
Jordan		
Greece		
Cyprus		
Bhutan		
Burundi		
Rwanda		
Austria		
Burkino Faso		
Mali		
Switzerland		
Albania		

COUNTRY	CAPITAL	PAGE NUMBER
United Arab Emirates		
Bulgaria		
Moldova		
Lithuania		
Senegal		
Latvia		
Guinea Bissau		
Estonia		
Afghanistan		
Pakistan		
Russia		
Turkmenistan		
Ukraine		
Nepal		
Byelarus		
Tibet		
Kazakhstan		
India		
Armenia		
Mongolia		
Uzbekistan		
Vietnam		
Cambodia		
Laos		

MAN-MADE DISASTERS

Preview of Main Ideas

Man-made disasters are international - they occur in developed and developing countries. As with natural disasters, they cause human and economic loss and displacement. Some are caused by war, some by greed, some by politics, and some by simple human error. In all cases, however, local culture and customs must be considered when developing strategies to prevent or to respond to man-made disasters. In this lesson, students will analyze several man-made disasters, locate them on a world map, and discuss the political, cultural, economic, and environmental elements of each and will brainstorm ways countries can develop emergency plans for man-made disasters. (Teacher may want to follow this lesson with the simulation activity found in "Refugee Movement Simulation.")

Connections with the Curriculum

Social studies: current events, world cultures, politics
Geography: mapping skills, interregional relations
Science: ecological impact of technological disasters, solutions
English; research paper on man-made disasters, debate

Teaching Level: Grades 7-12
Geographic Themes: Location, Place, Human/Environment Interactions, Movement, Region

Materials

National Geographic, August 1991, "The Persian Gulf After the Storm"
National Geographic, June 1991, "Europe's Dark Dawn"
State of the Earth Atlas, Maps #25 "Industrial Waste" ; #26"Deadly Industry"; #29 "War Wasted Lands"; and # 30, "Nuclear Blight."
"Chernobyl" - Part of **World Disasters** Book Series. 64 pp., hardcover.
Reading Level: Grades 5-8, Interest Level: Grades 4-12
OR various newspaper clippings, magazine articles on man-made disasters (Bhopal, Chernobyl, Three Mile Island, Love Canal, Minamata, etc.)
World Atlases, Almanacs
Wall Map
Large blackboard or large sheets of newsprint
Markers, pencils, tape
Reference Map A - World Map (pg. 80)
Handout # 1 - "Geothemes"
Optional Videos:
Video on Chernobyl - "Chernobyl: Chronicle of Difficult Weeks", 53:52 minutes, 1986. Dir. Vladimir Shevchenko. Video Four of 12-Tape "Glasnost Film Festival".
Video: "Tides of War" (on the Kuwait oil field fires) available for free loan from the Embassy of Kuwait (Telephone: 202-364-2100)

Objectives

Students are expected to:

- Brainstorm and identify the elements of a man-made disaster.
- Discuss and identify various man-made disasters.
- Research several recent or historical man-made disasters.
- Analyze and discuss the political, economic, cultural, and ecological dimensions of each disaster.
- Locate on a world map the site of the disaster and the area of impact.

Suggestions for Teaching the Lesson

OPENING THE LESSON

Have students collect and read articles on various man-made disasters, (including the *National Geographic* articles mentioned) or show clips from Kuwait and/or Chernobyl videos.

DEVELOPING THE LESSON

1. Have students brainstorm a definition for "man-made disaster" Use large sheets of newsprint or the board to record student ideas. If you have done lesson on "Natural Disasters", compare and contrast both natural and man-made disasters.) Save for #5 below.

2. Have class brainstorm elements that man-made disasters have in common. List these elements on board or newsprint. Save for #5 below. These should include:

   - loss of life and health
   - destruction of property
   - displacement of peoples
   - mobilization of community, country, world
   - loss of essentials necessary for life
   - long-term or irreversible ecological damage
   - social chaos - rioting, looting, imposition of martial law
   - interruption of communication

3. Have students brainstorm elements that distinguish the various man-made disasters and their causes. Save for #5 below. List should include:

   - chemical
   - nuclear
   - war damage

   Causes might include:

   - human error
   - politics
   - greed
   - mechanical malfunction
   - war
   - cultural practices

4. Discuss recent man-made disasters. Have students name as many as they can think of. List them on board or on large sheets of newsprint.

5. Divide students into groups and assign each group one of the disasters from #4 above. Give each group Reference Map A and Handout #1. Discuss "Geothemes" (see teachers' introduction).

   Provide articles, etc. on the disaster or have students go to the library to research the disaster. Each group should have a recorder and a reporter. Each group is to examine the disaster in terms of the elements the class came up with in #2 and #3 above and have the recorder write down what the group has researched on each element for the disaster. Have students include as much information about the peoples and cultures of the areas affected by the man-made disaster and speculate on how local cultures and customs may determine how a man-made disaster is handled. At the end of the activity, the reporter should report to the class what the group discovered.

CLOSING THE LESSON

Have students locate on a world map the sites of the disasters that they have researched. Have students use a different color pen or marker for each of the man-made disasters they have researched. (**Optional:** Compare the students' map with the maps from ***State of the Earth Atlas***. Use the "Geothemes" handout to discuss patterns and effects of man-made disasters.)

Some questions you might ask your students include:

Are there patterns for man-made disasters/ Why or why not?
Are man-made disasters predictable?
What can be done to prevent man-made disasters or to minimize the impact?
What elements must be taken into consideration in planning for man-made disasters?

EXTENDING THE LESSON

Have students do "Refugee Movement Simulation".

John Stedman, Manchester High School

HANDOUT #1 - Man-Made Disasters

"***Geothemes***"

GEOTHEMES

Examine each type of natural disaster in terms of the five Geothemes.

The five themes are:

Location
Place
Human/Environmental Interaction
Movement
Region

Ecologically Fragile Environments

Desertification: A Case Study of the Sahel in Africa ..... page 22
Edward Lang

Simulation: Desertification in Africa's Sahel ..... page 27
Edward Lang

Rainforests of the World: Where They Are and Why They Are Important ..... page 29
Sheila Spellacy

Rainforest Role Play ..... page 34
Caryn White

A World of Ways to Meet Our Needs ..... page 39
Carol Phillips

DESERTIFICATION - A CASE STUDY OF THE SAHEL IN AFRICA

IMPACT OF POPULATION INCREASE ON ENVIRONMENTALLY FRAGILE ECOSYSTEMS

Preview of Main Ideas

Population in a region increases by natural growth or by immigration. As population increases, there is direct impact on the environment. The impact of population increase on fragile environments is much more dramatic and occurs at a much faster pace than it does on resilient ecosystems. In this lesson, students will study and analyze the impact of increased population pressure on the Sahel and the resultant desertification. A second lesson - a simulation which follows - will graphically demonstrate this process.

Connections with the Curriculum

Social studies: current events, history, geography
Environmental studies
Science: physical science

Teaching Level: Grades 7 - 10
Geographic Themes: Location, Place, Region, Human-Environment Interactions, Movement

Materials

Any good secondary World Geography Text
Almanacs
Atlases
Reference Map A - World Map (pg. 80)
Reference Map B - Map of Africa (pg. 81)
Handout #1 "Population Increase"
Handout #2 "Sahel"
Handout #3 "Desertification"
Article - "Africa's Stricken Sahel", *National Geographic*, August 1987
Article - "The Landscape of Hunger", *Audubon*, March-April 1993
Suggested supplementary materials:
The State of the Earth Atlas, ed. Joni Seager (New York: Touchstone/Simon & Schuster) 1990, especially Maps # 11 & 21.
Connections Linking Population and the Environment, The Population Reference Bureau, Inc., Washington, D.C., 1991. Lessons 3.4 "Living on the Edge" and 3.5 "Survival."
Video: **Connections**, by Todd A. Gipstein, National Geographic Society
Software: P.C. Globe, World Atlas

Objectives

Students are expected to:

- Understand some of the ways population increases in particular areas.
- Explore the process of desertification.
- Research the geography and ecology of the Sahel.
- Understand what makes an ecosystem fragile, and how rapidly a fragile ecosystem can be adversely impacted.

Suggestions for Teaching the Lesson

OPENING THE LESSON

1. (*optional*) Show the video **Connections** by Todd Gipstein. Discuss the video and brainstorm on the importance of and impact upon us of events that occur far away.

DEVELOPING THE LESSON

1. Divide the class into three groups; (if you have a large class, you may wish to have six groups, with two groups each working on one handout). Give each group one of the handouts (#3 "Population Increase"; #4 "Sahel", or #5 "Desertification"). Have each group use the materials listed above (atlases, almanacs, etc.) in the classroom or library to complete the worksheets.

2. Have each group report on the research to the entire class while the class takes notes.

3. Assign the *National Geographic* and *Audubon* articles as in-class or homework reading. Have students compare the notes from their research with the information in the articles and report to the class on the comparisons.

4. Using Maps: Use Reference Maps A & B (World Map and Map of Africa). Have students label the countries of the Sahel on the blank map of Africa. In how many countries does the Sahel lie? Have the students transcribe this to the blank world map and discuss the global perspective.

CONCLUDING THE LESSON

Have the students use all of their research, observations, and analysis to speculate on the future of the Sahel region over the next twenty years. Are there different scenarios? What might they be? What events could alter these predictions?

EXTENDING THE LESSON

Have students examine other regions which are experiencing desertification. (See ***State of the Earth Atlas*** map #11.) Compare the experiences with other areas to that of the Sahel.

Edward Lang, Norwich Regional Vocational Technical High School

HANDOUT #1 - Desertification

Population Increase Worksheet

Define: population

Define: Natural Population Growth

Define: immigration

List at least four causes of immigration

HANDOUT #2 - Desertification

Sahel Worksheet

Define: Sahel

Where is it located?

Name the countries of the Sahel.

How is land used in the Sahel?

What are the climate and vegetation of the Sahel?

HANDOUT #3 - Desertification

Desertification Worksheet

Define: desertification

Where is desertification occurring?

List at least three causes of desertification.

Why is desertification an international disaster?

What might be some ways to prevent desertification?

SIMULATION: DESERTIFICATION IN AFRICA'S SAHEL

Preview of Main Ideas

This activity is used as a follow-up to the "Desertification" lesson and as a tool for reinforcing things that were learned about desertification of fragile environments.

Connections with the Curriculum

Social studies: current events, history, geography
Environmental studies
Science: physical science

Teaching Level: Grades 7 - 10
Geographic Themes: Human-Environmental Interactions, Movement, Region

Materials

Clock
Baggies
Box of Cheerios (or any small, edible items - remember that the students will be consuming the items)

Objectives

Students are expected to:

- Participate in a simulation on population increase in regions with limited resources.
- Understand the increasing demands on existing resources caused by immigration of displaced populations.
- Analyze ways in which regions must reallocate resources to meet the demands of immigration.

Conducting the Simulation Activity

1. Tell the students that the classroom is a region that is experiencing desertification. Tell them that each row of desks in the room represents a five mile stretch of the Sahel from north to south. The front row of desks therefore represents from the northernmost extreme of the Sahel to five miles south. The second row of desks represents that section of the Sahel from five miles to ten miles south. Continue in this manner until you have five rows, the last row representing twenty to twenty-five miles south from the front row.

2. Now have an equal number of students sit in each of the five rows. Assign one student in each row to be the leader.

3. Explain that ten minutes of class time represents one year in the Sahel.

4. The leader is responsible for allocating resources in his/her region. Give each leader a baggie which contains five Cheerios for each person in the row. (If there are four students in the row including the leader, the leader's baggie should contain twenty Cheerios.) This represents one year's subsistence for the population of that row.

5. Tell the students that when you signal the start time, they are to consume the Cheerios at a rate of one every two minutes.

Tell the class that in this region, consuming the resources at this rate of one every two minutes is enough to maintain life. However, if because of drought or increased population the resources are consumed before the year is up, the population must move to an area with resources left to share.

6. Signal the time and have the leader distribute one Cheerio to each student every two minutes.

7. At the beginning of the second "ten minute" year, tell the class that there is a drought in the northernmost part of the Sahel. Remind the class that these resources not only represent food for the human population but also grazing resources for their flocks.

   Because of the drought, the first row now only receives one Cheerio for each person while all other rows receive the original allotment of five per student. (Two minutes into the second ten minute year the population in the first row will have consumed all their resources (i.e. eaten all the Cheerios), their flocks have over-grazed what little vegetation there was and their area has become a wasteland incapable of sustaining a human population. The desert has moved south.

8. The population from the first row must now migrate to row two or perish. The remaining rows do NOT get more Cheerios when a new group moves in, but must reallocate the existing resources. Thus, the leader in row two now has to share the remaining resources (Cheerios) with the immigrant population at the same rate, one every two minutes per student. (You may wish to point out to the students that there are now only half as many resources per person).

9. Six minutes into the second ten minute year all of row two's resources have now been consumed and all of the people now in row two must move south into row three if they are going to survive. The desert has moved further south.

   At this time everyone from rows one and two should be in row three.

10. Continue the activity until all the rows have been forced to evacuate their land. It should have become quite apparent that as this process continued the pressure on resources reached the breaking point in a relatively short time.

Debriefing the Simulation

1. What is the snowball effect and did it come into play in the simulation?

2. Why did the moving groups of people not have any resources to bring with them?

3. What happened to the original five resource units (Cheerios) per person?

4. Could the leader have decided on a different way of allocating the resources (Cheerios) - for example, instead of allowing the population of his/her row one every two minutes, allocated one every four minutes?

5. What other options might the leader have had for reallocation of resources?

6. Why did the vacated areas produce no resources?

7. Draw upon what you learned from the lesson on Desertification, and think of why a desert spreads into areas that had previously been marginally inhabitable.

RAINFORESTS OF THE WORLD: WHERE THEY ARE AND WHY THEY ARE IMPORTANT

Preview of Main Ideas

The people throughout the middle and high latitudes depend on the products of the rainforest just as much as people of the rainforest/tropical regions of the world do. This lesson will encourage students to become aware of the location of the remaining major rainforests. The products derived from the diversity of the plant species found only in the rainforest are emphasized. The fragile environment is being altered and is disappearing at an alarming rate. This integrated lesson allows students to select from a list of trade books and then better understand the need to preserve the remaining rainforests.

Connections With the Curriculum

Geography, Language Arts, Social Studies

Teaching Level: Grades 4-8
Geographic Themes: Location, Region, Place, Movement

Materials

Reference Map A - World Map (pg. 80)
Handout #1 - List of Rainforests
Handout #2 - Bibliography for Students
Handout #3 - List of Common Products Derived from Rainforest
Atlases, Almanacs
Video "Fern Gully" or other appropriate visual

Objectives

Students are expected to:

- Construct a thematic map indicating the location of rainforests.
- Understand that the rainforest supports a great diversity of plant species.
- Recognize the variety of products derived from the rainforests.
- Evaluate the necessity of preserving the rainforests.

Suggestions for Teaching the Lesson

OPENING THE LESSON

Students will participate in a discussion of products used and consumed in their daily lives. Because ingredients of many of these originate in the rainforests, students will create a thematic map of remaining major rainforests using Handout #1.

DEVELOPING THE LESSON

Students will choose a book from the student bibliography (Handout #2). After reading and reporting on selected books, and viewing a rainforest video, the students will formulate fact sheets about the rainforest, and reasons for protecting the remaining forests.

CONCLUDING THE LESSON

Using cooperative groups, students will research the products of the rainforest (Handout #3) - what each product is, the nation of origin and how the product is used today. Students should be encouraged to add products to this list.

EXTENDING THE LESSON

Students may plan a "Rainforest Day" with products of the rainforest on display and sample foods from the rainforest.

References and Resources

Friend, Tom, "A treetop classroom in the Amazon", *USA Today*, March 23, 1993.

Hale, Francis, "A Raft Atop the Rain Forest", *National Geographic* 178 (4): 129-138 (October 1990).

Heltshe, Mary Ann and Kirchner, Audry Burie, **Multicultural Explorations**, Teacher Ideas Press, Engelwood, CO, 1991.

Hughes, Carol and David Hughes, "Teeming Life of a Rain Forest", *National Geographic* 163 (1): 48-65 (January 1983).

Koenig, Herbert G. Dr., **Environment Events Assessment Response**, N & N Publishing Company, Middletown, NY, 1993.

Landau, Elaine, **Tropical Rain Forests Around the World**, Franklin Watts, New York, 1991.

White, Peter T., "Nature's Dwindling Treasures: Rain Forests", *National Geographic* 163 (1): 2-47 (January 1983).

Wilson, Edward O., "Rain Forest Canopy: The High Frontier", *National Geographic* 180 (6): 78-108 (December 1991).

Sheila Spellacy, East Hartford Middle School

Handout #1 - Rainforests of the World

Major Tropical Rainforests of the World

South America
Manaus (Amazon Rainforest), Brazil
La Planada Nature Reserve, Colombia
Pacaya-Samiiria National Reserve - Manu National Park, Peru
Petit Saut, French Guiana

* Venezuela, Suriname, Ecuador, Guyana and Bolivia

Central America/Caribbean
Rio Macho Forest Reserve, Costa Rica
Mexican Tropical Forest, Mexico
Caribbean National Forest, Puerto Rico
Mosquitta Forest, Honduras
Barro Colorado Island, Panama

* Dominican Republic, Trinidad, Tobago, Guatemala and Belize

Africa
Campo Forest Reserve, Cameroon
Kibale Forest Reserve, Uganda
Rainforest, Madagascar

* Zaire, Gabon, Ivory Coast, Liberia Central African Republic, Nigeria, Sierra Leone, Ghana, Guinea, Benin and Angola

Asia
Sinharaja Forest Reserve, Sri Lanka
Pasoh Forest Reserve, Malaysia
Gunung Palung National Park, Indonesia
Ladan Hills Forest Reserve, Brunei

* India, Bangladesh, China, Papua New Guinea, Philippines, Thailand, Burma, Vietnam and Kampuchea

Australia/Pacific Islands
Davies Creek, Queensland, Australia

* Fiji Islands and Solomon Islands

NOTE: It might be interesting to have students research rainforests prior to 1950 and 1970 and then compare with 1993 thematic map. These maps would indicate the extent of deforestation.

* Nations that have some areas of rainforest remaining

Handout #2 - Rainforests of the World

Rainforest Bibliography for Students

Aldis, Rodney. **Rainforests** (Ecology Watch Series). New York: Dillon Press, 1991. [(ISBN 87518-495-2) Gr. 5+ $13.95]

Baker, Lucy. **Life in the Rainforests** (Life In Series). Chicago, IL: Franklin Watts, 1990. [(ISBN 0-531-10983-6) Gr. 6+ $12.40]

Banks, Martin. **Conserving Rain Forests** (Conserving Our World Series). Austin, TX: Raintree Steck-Vaughn, 1990. [(ISBN 0-8114-2387-5) Gr. 5+ $14.95]

Bright, Michael. **Tropical Rainforest** (World About Us Series). Chicago, IL: Franklin Watts, 1992. [(ISBN 0-531-17301-1) Gr. 5+ $11.90]

George, Michael. **Rainforest** (Images Series). Columbus, OH: American Education Publishing, 1992. [(ISBN 0-88682-483-4) Gr. 4+ (IL 2-12) $17.95]

Hare, Tony. **Rainforest Destruction** (Save Our Earth Series). Chicago, IL: Franklin Watts, 1990. [(ISBN 0-531-17248-1) $12.40]

Landau, Elaine. **Tropical Rain Forests Around the World** (First Book Series). Chicago, IL: Franklin Watts, 1990. [(ISBN 0-531-10896-1) Gr. 6+ $12.40]

Lewington, Anna. **Rainforest Amerindians** (Threatened Culture Series). Austin, TX: Raintree Steck-Vaughn, 1993. [(ISBN 0-8114-2302-6) Gr. 5+ $14.95]

Mallory, Kenneth. **Water Hole: Life in a Rescued Tropical Forest** (New England Aquarium Books - Endangered Habitat Series). Chicago, IL: Franklin Watts, 1992. [(ISBN 0-531-11154-7) Gr. 6+ $15.90]

Newman, Arnold. **Tropical Rainforest: A World Survey of Our Most Valuable Endangered Habitat - With A Blueprint for its Survival**. New York, Facts on File, 1990. [(ISBN 0-8160-1944-4) Gr. 7+ $45.00]

Siy, Alexandra. **The Brazilian Rain Forest** (Circle of Life Series). New York: Dillon Press, 1992. [(ISBN 0-87518-470) Gr. 5+ $14.95]

Siy, Alexandra. **The Waorani: People of the Ecuadoran Rain Forest**. New York: Dillon Press, 1993. [(ISBN 0-87518-550-9) Gr. 5+ $14.95]

Handout #3 - Rainforests of the World

Products of the Rainforest

Product	Nations of Origin	Modern Day Usage
Allspice		
Avocado		
Balata		
Balsa		
Bamboo		
Baobab		
Brazil Nuts		
Cacao		
Cassava		
Cassia		
Cherimoya		
Chicle		
Cinchona		
Clove		
Coffee		
Copal		
Curare		
Epiphytes		
Feyoa		
Ginger		
Guavas		
Kapok		
Lianas		
Mahogany		
Mangoes		
Manioc		
Palm		
Plantian		
Quinine		
Rafflesia		
Rubber		
Strangler Fig		
Sugarcane		
Teak		
Turmeric		
Vanilla		

RAIN FOREST ROLE PLAY

Preview of Main Ideas

Preservation of environmentally fragile or threatened ecosystems is a complex issue involving conflict over what constitutes appropriate use of resources, competing economic interests, and conflicting values and ethics. In many cases, there are no clear-cut solutions. Students will be exposed to some of the issues involved in the efforts to preserve the rain forest while recognizing the rights of peoples to maintain their livelihoods. Students will research some of the issues, including the case of "Chico" Mendes, and engage in a role play among farmers, ranchers, rubber tappers, and a biologist from an international environmental agency.

Connections With the Curriculum

Geography, social studies, current events, physical science, environmental studies, and conflict resolution.

Teaching Level: Grades 6-10

Geographic Themes:

Human-Environmental Interactions - how indigenous people use resources, impact of ranchers and clearing
Region - climate, geological, economic, cultural, linguistic
Movement - movement of ranchers into rainforest, removal of resources, impact of international agencies
Location - rainforests occur only within certain range

Materials

Handout #1 - The Situation
Handout #2 - Rancher
Handout #3 - Farmer
Handout #4 - Rubber Tapper
Handout #5 - Biologist
Large World Map
Atlases
Butcher paper, tape, pens

Optional additional materials:

"High Frontier of the Rain Forest Canopy", *National Geographic*, Vol. 180, No. 6, December 1991.
Siy, Alexandra, **The Brazilian Rain Forest** (New York: Dillon Press), 1992.
DeStefano, Susan, **Chico Mendes: Fight for the Forest** (Frederick, Maryland:Twenty-first Century Books), 1992.
Seager, Joni, **State of the Earth Atlas,** Map #5, "Rain forest" or world atlas with rain forest map.

Objectives

Students are expected to:

- Identify location of world rainforests on world map.
- Recognize that the rainforest supports the greatest diversity of species.
- Locate Brazil on a world map.
- Develop an understanding of different points of view regarding use of resources.
- Investigate the lifestyles and needs/concerns of four different kinds of people with interests in the rainforest: rancher, farmer, rubber tapper, biologist.
- Identify these needs and priorities; analyze and identify points at which these come into conflict.
- Attempt to work out a solution to the conflict (synthesis).

Suggestions for Teaching the Lesson

OPENING THE LESSON

1. Have students review locations of worlds rain forests. (refer to Map #5 from ***State of the Earth Atlas*** or map in "High Frontier of the Rain Forest Canopy" ***National Geographic*** or atlas. Have the class brainstorm the various threats they know about to the rain forest. Focus upon the Brazilian rain forest. (The students should come up with cattle ranching, farming, harvesting trees for lumber, mining industry). Record these on butcher paper and save for debriefing below.

2. Discuss WHY people are moving into the rain forest to establish farms and ranches. Discuss the human needs that people are seeking to fill by cutting down the rain forest.

3. Tell the class that they will engage in a role play/conflict resolution over conflicting interests in the Brazilian rain forest. Divide the class into groups of four and assign each member of the group a role. Give the students the handout which describes their role and have them study the role. They are NOT to share their role with the other members of the group. The group must try to come up with a solution to the problem presented.

4. Read the scenario on Handout #1, distribute one copy to each group, or project it with an overhead, or print it on another sheet of butcher paper and post it for each group to see.

5. Have student role play in their groups for 10 - 15 minutes. Stop the role play and have each group report their solution. Alternately, with a small class, give each group 5 minutes to prepare and have the group enact the role play in front of the rest of the class.

6. Debrief the group, and record answers on butcher paper. Ask the following questions:

   - Did you discover any additional threats to the rain forest through your role play? Add to the butcher paper sheet from #1 above.
   - What were the interests of each character? (What did the cattle rancher want? The rubber tapper? the biologist? the farmer?)
   - Were their needs legitimate? Could their needs be met any other way?
   - How did each student feel in his/her role? How did each student feel about the needs/demands of the others? How do you think people like these four characters in Brazil might feel?
   - Were you able to resolve the situation? Was everybody completely happy with the solution? Why or why not?

CONCLUDING THE LESSON

On butcher paper, put together a list from the role play and other readings of people who have interests in the rain forest. This might include lumber companies, indigenous peoples, in addition to the four from the role play. Note their interests and have students predict which interests might be in conflict. Discuss possible solutions.

EXTENDING THE LESSON

Have students research the case of Chico Mendes and report to the class on his murder.

Teacher Reference:

Shoumatoff, Alex, **The World is Burning: Murder in the Rain Forest** (Boston: Little Brown and Co.) 1990.

Caryn White, East Asian Resource & Education Program Director, Yale University

Handout #1 - Rain Forest Role Play
The Situation

The Scenario

Members of several groups have joined together to have an area of jungle in Xapuri declared a preserve. Representatives of groups who favor the establishment of a preserve as well as those who oppose it have gathered to discuss the proposal and to make their cases.

Take the role of one of these people and argue your case for or against the establishment of a preserve. Following your argument, discuss with the others possible solutions to the conflict. Be creative in taking on the case of your character. Try to imagine how you would feel if you were in this person's position.

Handout #2 - Rain Forest Role Play

Rancher

Antonio is a cattle rancher. He has worked very hard on his ranch, clearing thousands of acres of jungle to develop his herd. He feels that not only is he supporting his family and providing a comfortable life for them, but he is helping his country by raising beef for export - an activity which provides Brazil with much-needed foreign exchange. He believes that he and cattle ranchers like him who have exercised private initiative are the true heros of Brazil, those responsible for generating much of the wealth of the country. He feels that members of the environmental movement and the rubber tappers are left-wing, maybe even communists, who will undermine the prosperity of Brazil. He has heard rumors that other ranchers in his organization, the U.D.R. (Rural Democratic Union) have been behind the murders of environmental activists, but he doesn't believe it. In fact, there is no direct proof of U.D.R. involvement in a single killing. Now Antonio has heard that environmental activists and rubber tappers are trying to close off an area of Xapuri as a preserve. Some of this land is land that Antonio had planned to add to his ranch.

Handout #3 - Rain Forest Role Play

Farmer

Joaquim and Lucía and their four children had lived in a crowded, filthy slum in northeastern Brazil until the government offered them a plot of land, a two-room house and a salary to move to the jungle and carve out a farm. The government promised to build schools and hospitals for the new settlers. Joaquim and Lucía saw this as an opportunity for themselves and their children to raise themselves from poverty and provide a future for their children. They moved into Xapuri and cleared a plot of land which they began to farm. Although it has been a struggle, the family has persisted. The land has not proved to be as fertile as they had hoped and they have had to acquire additional lands to clear to keep up their production. Now Joaquim and Lucía have heard that a group of tappers and Indians want to have the area declared a reserve, which would prevent them from clearing more land and may even force them to move.

Handout #4 - Rain Forest Role Play

Rubber Tapper

João has been a rubber tapper for most of his life. João's father was a rubber tapper, and when João was seven, his father started taking him out into the jungle where he learned to collect the milky juice from the bark of the rubber tree. Now João gets up before dawn, eats a breakfast of coffee and manioc (a dark tropical oatmeal), collects his equipment - a special knife for cutting the rubber trees, a machete for hacking his way through the jungle, cups and buckets for collecting the latex, and his helmet with a kerosene lamp on it to light his way through the jungle. João learned from his father how important it was to understand the ecology of the jungle. Rubber tappers depend on a healthy environment to maintain their livelihoods, so they know that they must not cut into the same tree day after day, but rather harvest latex from different trees. Like João, they know that they must make the cut carefully - deep enough to allow the latex to flow, but not too deep to harm the tree.

Recently, João's way of life has been threatened by development. Farmers and ranchers have come into the jungle along BR-364, the Trans-Amazon Highway, and have cut large areas of forest for their farms and ranches. João and other rubber tappers have joined with the Indians of the rain forest to stop the destruction. Now the rubber tappers, Indians and others who wish to preserve the rain forest want to have a large area in Xapuri declared a reserve.

Handout #5 - Rain Forest Role Play

Biologist

François Peltiere is a French biologist who has spent his adult life researching insects in the rain forest canopy. He has been especially interested in the relationship between insects of the canopy, such as the symbiotic relationship between treehoppers and ants. Over the years, he has returned again and again to an area of Xapuri to continue his work . During the years, he has seen the area which he has conducted his research grow smaller as more and more of the rain forest is cut for farms and ranches. François has become a radical environmentalist. He believes that there is nothing wrong with destroying chain saws and bull dozers. He has watched the rivers grow polluted from mining waste. He has had several angry encounters with construction crews and cattle ranchers. He has even received death threats for his support of conservation efforts. Now he has heard that a group of rubber tappers and Indians are fighting to set aside a part of Xapuri as a preserve.

A WORLD OF WAYS TO MEET OUR NEEDS

Preview of Main Ideas

Man lives in a physical environment in which he can adapt to meet his needs. Both his way of life and they physical landscape may be modified to meet those needs. The activities in this unit will lead children to consider their needs and the ways they are met by the geography of their community.

They will contrast their own community with the vanishing nomadic/semi-nomadic cultures still found in other parts of the world (desert, dry grasslands, tundra) where man has survived by herding, gathering, and hunting.

Older children may investigate nomadic cultures that are being disrupted by governmental planning or by the influences of modern technology and the affluence offered by urban areas. They may study the impact that this has had on the fragile soil of the land that was shared by the nomadic groups and the animals they herded or hunted.

Connections With the Curriculum

Social studies, environmental studies, sociology, literature, and art.

Teaching Level: Grades 1-6
Geographic Themes: Human-Environmental Interactions, Region, Location, Place, Movement

Materials

A good supply of pictures from *National Geographic* and other magazines, calendars, etc. that show:

- areas typical of the student's own and other U.S. communities
- a variety of arid/semi-arid landscapes inhabited by man (e.g. desert, tundra, savanna, steppe)
- scenes of nomadic/semi-nomadic life

Chart paper, transparencies, markers
Maps, globes, atlases
Reference Map A - World Map (pg. 80)
Old issues of *National Geographic*
Book: **Andrew Henry's Meadow** by Doris Burns (Coward-McCann, 1965)
Video: "Caribou Hunting at the Crossing" from **Man: A Course of Study** (Documentary Educational Resources, Watertown, MA) or other video of your choosing

Objectives

Students are expected to:

- Understand the differences between basic needs and needs based on interests.
- List needs and how the physical environment may influence the way these needs are satisfied.
- Be community developers, choosing a site and building a town to meet residents' needs.
- Appreciate that human needs can be met in seemingly uninhabitable environments.
- Understand that the most seemingly alien environment can be loving and nurturing.

Suggestions for Teaching the Lesson

DAY 1

1. Read **Andrew Henry's Meadow** to the children.
2. Discuss the interests of each child in the story and how their needs were met in the meadow.
3. List the physical attributes of the meadow.
4. Discuss the needs of the children that made them willing to return to their homes.

DAY 2 - Group Activity

1. Divide into small groups.
2. Give each group a picture of an area typical of their own community (urban, rural, suburban) to study.
3. Groups will list everything seen in the picture that relates to or meets human needs.
4. They should look for geographical features and modifications man has made to the environment.
5. Each group will share lists of way needs were met in their study print.

DAY 3 - Small Group Activity in an outdoor area

1. A group of 2-3 will plan a community and "construct" a mini-village for 1/4" residents that meets man's needs by utilizing and modifying the physical features of a selected site.
2. Each group will map their community on chart paper or overhead transparency.
3. Each group will present their village plan and explain how it meets the needs of its inhabitants.

DAY 4 - Group Activity

1. Give each group pictures of one of three regions -- desert, dry grasslands (steppe, savanna), or tundra.
2. Using the pictures, they will list the physical characteristics of the region and the ways they think the inhabitants meet their needs.
3. Each group will present pictures they have studied and their thoughts about living in those places to the class.

DAY 5 - Summary/Class Activity

1. View the film "Caribou Hunting at the Crossing" from **Man: A Course of Study** and compare the hunting culture of the tundra to ours.
2. Use a Venn diagram to compare and contrast ways "modern" communities and nomadic communities meet human needs.

EXTENDING THE LESSON

Grades 1-3

Read to class: **The Wump World, Coyote Cry, The Desert is Theirs, Little House, Little House in the Big Woods** (see bibliography for source information). Have children relate these stories to how man meets his needs in different environments.

Grades 4-6

Home reading assignment: **The Wave, Julie of the Wolves, My Side of the Mountain, Hatchet**. In writing or pictures, tell or show how the characters dealt with their particular environment in order to meet their needs.

Grades 2-6

Map Activity: Indicate on a map of the world the areas of desert, dry grasslands and tundra.

Grades 4-6

Research and report on present day nomadic and semi-nomadic groups:
Tauregs, Teda, Aborigines, Fulani, Kurds, Mongols, Bushmen, etc.

By Carol Phillips, Coventry Grammar School

A WORLD OF WAYS TO MEET OUR NEEDS

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Video:

"Caribou Hunting at the Crossing", from **Man: A Course of Study**, a social studies curriculum. Contact: Judith Nierenberg, Documentary Educational Resources, 101 Morse St., Watertown, MA 02172. Phone: (617) 926-0491

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THE ECOLOGICAL DANGERS OF MONOCULTURE

Preview of Main Ideas

Monoculture, the production of a single crop over a large geographic area, threatens existing eco-systems and their bio-diversity. Monoculture increases the likelihood of economic disaster and famine in regions dependent upon it. In this activity, students will complete a fable of a disaster brought on by monoculture and then identify real-life regions which are heavily dependent upon specific crops. They will do research to find out what the crop requires, why people grow the crop, what problems are solved and what problems are created by growing the crop, and what natural vegetation was growing in the area before the introduction of the monoculture. They will be required to think of alternate strategies for earning a living using native vegetation.

Connections With the Curriculum

Social Studies: geography, history, English, creative writing
Science: biology, ecology, environmental issues, agriculture

Teaching Level: Grades 5-8
Geographic Themes: Region, Location, Movement, Human-Environmental Interactions, Place

Materials

National Geographic, Vol. 179, No. 4, April, 1991. "The World's Food Supply At Risk" (especially map on page 84-85)
State of the Earth Atlas, Map #10, "Shrinking Genes"
Names of crops which are monocultured
World Map
World Map depicting natural vegetation
Encyclopedias
Atlases
Almanacs
Reference Map A - World Map (pg. 80)
Handout #1 "Crittoria" fable
Handout #2 - Group Questions
Colored pencils or pens, tape

Objectives

Students are expected to:

- Use their imaginations to complete a monoculture fable.
- Research agricultural practices associated with various crops.
- Synthesize information from a variety of sources.
- Make deductions and draw conclusions based upon research.
- Develop map skills.
- Create a fable to teach younger students about the dangers of monoculture .

Suggestions for Teaching the Lesson

OPENING THE LESSON

1. Divide the students into groups. Tell them that they are going to hear a story about a disaster that they must finish.

2. Hand out the reading on "Crittoria" and have the students read it or read it aloud to the class.

3. Ask each group to come up with a scenario to conclude the story.

4. When the students have worked on a ending (15 - 20 minutes) have them report their conclusions to the class.

5. Discuss the conclusions and possible solutions to the problem. Explain to the students that problems like those experienced by the Critters are real and caused by an agricultural practice known as **MONOCULTURE.** (You may wish to discuss the etymology of the word.) Tell them that they will do some research on problems caused by monoculture in real life.

DEVELOPING THE LESSON

1. Have students brainstorm a list of major cash and food crops grown around the world. Identify those that are often monocultured. Crops that might be identified include:

   potatoes
   rice
   tobacco
   sugar cane
   cassava
   sweet potato
   apples
   soy beans
   almonds
   citrus
   coffee
   tea
   maize

2. Divide students into groups. Have each group select or assign to each group a particular crop which is often monocultured. Give each group a Handout #1, the list of questions to research each crop and a copy of Reference Map A, the world map.

3. Have student color in the areas on the world map where their crop is grown in large, monoculture tracts.

4. Have students answer the questions from Handout #2.

5. After students have completed the research, each group should report its findings to the class. Have each group transfer their map to a master map, color coding the various crops.

6. After the groups have reported, class discussion should focus on:
   - identifying similarities among the situations reported on
   - identifying problems associated with monoculture
   - suggesting possible solutions to the problems

CONCLUDING THE LESSON

Have students develop their own fables about monoculture, using "Crittoria" as a model. Students should illustrate their fables and share them with younger students.

Chris Spinelli, Hartland Elementary School

Handout #1 - The Ecological Dangers of Monoculture

"*Crittoria: A Fable*"

Crittoria is a place populated by Critters who grow enormous fields of dandelions. They survive on dandelion tea, dandelion fritters, dandelion salad and bread baked from dandelion root flour. They get cash by selling dandelion products to the Button bellies who live up north. Not only are dandelions important for their economy, dandelions are a source of "Critter Pride." The Critter flag is a dandelion flower. The national drink, dandelion tea, is served with a special ceremony reserved only for the biggest dandelion growers. A great sense of honor goes to those who produce dandelions. Naturally, all of the Critters want to grow dandelions.

One year, a travelling circus rolled into Crittoria. Among the amazing acts and fabulous animals was the "Daring, Dangerous Dingbats" and their fearless trainer, Danforth Dibble Dillians. Now, the Dingbats ate dandelions, but seeing that dandelions were plentiful in Crittoria, no one worried and the "Critters" were more than happy to supply Mr. Dillians with dandelions to feed the Dingbats. One night, however, a careless circus hand left the Dingbats cage unlocked and the clever Dingbats escaped. All but two were captured and returned to the circus and the residents of Crittoria soon forgot about the circus. But Dingbats reproduce very quickly and soon there were a dozen Dingbats around Crittoria. Not too much later, there were hundreds, and the dandelion growers began to notice that their fields were being destroyed by swarms of hungry Dingbats. No matter what they did, they couldn't get rid of them, nor could they stop them from multiplying.

[students must finish the story]

Handout #2 - The Ecological Dangers of Monoculture

Monoculture Research Questions

1. What are the requirements for growing this crop?

2. In what regions of the world is this crop important? Locate these regions on the world map.

3. Do these regions have anything in common?

4. Why did the people of these regions start to grow this crop? When did they start?

5. What was growing on the land before people started growing this crop?

6. What things could cause this crop to fail?

TOURISM: CONSERVATION BOON OR BANE

Preview of Main Ideas

Tourism is an industry upon which many countries are dependent for economic existence. However, tourism can greatly influence the politics, the culture, and the environment of an area. The influx of large numbers of tourists may change a region (hotels, beaches, the increased amount of refuse and larger amounts and varieties of food, etc.). Many places of interest to the tourist are ecologically fragil and very sensitive to the influx of large numbers of people. In this lesson, the students will use their mapping skills to determine the needs of tourists visiting their chosen vacation spot, as well as determine the needs of the host country. Students will compile possible suggestions to keep the environment healthy for both tourists and local people.

Connections With the Curriculum

Social Studies, Geography, Health, Science, English and Math

Teaching Level: Grades 5 and up
Geographic Themes: Location, Place, Human-Environmental Interactions, Movement, Region

Materials

Booklets from travel agencies on travel to national parks in Thailand, Nepal, Niger, Mexico and Rwanda
Travel books on these countries
Maps
Atlas
Handout #1 - "Tourism offers hope, but development continues to erode fragile ecosystem"
Hartford Courant, Sunday, June 20, 1993
Handout #2 - "Nature Tourism", *People and Parks*
Handout #3 - "Ecotourism", *American Museum of Natural History*
Copies of Reference Maps if desired (pp. 80-84)
Optional Resource:
State of the Earth Atlas, Map #3, "Tourist Traps"
Understanding Our World Through Geography, Jerry Aten, Good Apple Social Studies

Objectives

Students are expected to:

- Understand how to calculate distance, time and seasonal changes.
- Determine possible needs of both tourist and local people.
- Research a selected location and interpret the needs of the visitor and the host in keeping the environment friendly.
- Compile suggestions to keep the environment globally working and share these suggestions with other grade level students, heads of appropriate departments, agencies or newspapers.

Suggestions for Teaching the Lesson

OPENING THE LESSON

1. Distribute Handout #1. Have students read the *Hartford Courant* article on tourism to ecologically fragile world areas. Tell students that they will plan a trip to one such area.

2. Obtain brochures from areas such as those listed in Handout # 2.

3. Divide students into groups and have each group select an area from Handout #2 to visit. The students in

each group should read the brochures, use the atlas, and travel books to plan a trip to their destination. Have them locate first on the world map the site they will visit, then have them locate it on a regional map.

4. Each group should research and write out the location, relative and exact, of their destination, its climate, topography, peoples, languages, customs, religions, foods, etc.

5. Have students decide how to get to their destination, how many miles from Connecticut it is, and the difference in time. Indicate these on the blank world outline map.

6. Have students develop a list of items needed, what travelers will see, etc., what preparation they need in order to go to their destination (medical, clothing, etc.).

7. Each group should develop a list of the dangers to the ecology of their destination their trip might pose and how to avoid or minimize these dangers (i.e. litter, pressure on limited water resources, etc.). Each group should also develop a list of the benefits to their destination their trip might provide (i.e. economic incentives for local groups to preserve the environment as a way of attracting more tourists).

CONCLUDING THE LESSON

Have each group report on its destination, its plans, and the ecological benefits and dangers of tourism. Each group may put together a bulletin board or display illustrating their research.

EXTENDING THE LESSON

Role Play:

- Divide students in each group into two smaller groups, the tourists and the local people
- Have students role play the concerns of each group.
- Debrief and discuss how the needs of each group might be met.

Marian Calloway, CGA Teacher Consultant

Handout #1 - Tourism: Conservation Boon or Bane?

Tourism offers hope, but development continues to erode fragile ecosystem

Cuyabeno Wildlife Reserve is a fragile preserve, threatened by developers and settlers whose kindred spirits threaten the world's rain forests from Borneo to Brazil.

Proponents of Ecuador's burgeoning business in environmentally oriented tourism hope the influx of tourist dollars will convince the powers that be that undisturbed rain forests can be an economic asset.

But even here, the bogeyman of development is poking its unwelcome nose. The fast money generated by oil is a powerful temptation. Less than 20 miles from Imuya Camp's thatched huts, illegal oil exploration is taking place inside the reserve's boundaries. Workers are felling trees in preparation for constructing a drilling platform.

The oil industry has already trashed the nearby Napo River, the country's main Amazon tributary, in pursuit of petroleum's black gold. The Napo was, only a decade ago, the prime target of Amazon-bound adventurers in Ecuador. The frontier for viewing flora and fauna has since moved to the Aguarico, which carries the waters of Imuya and the Rio Lagarto to the Napo at the Peruvian border.

Wherever you go in the Amazon Basin, virgin rain forest is getting farther away and more difficult to reach.

Ironically, exploitation of the natural resources along the Napo and the subsequent flood of settlers led to the discovery of Imuya.

Metropolitan Touring, the tourism giant in Ecuador, had long operated a floating hotel, the triple-decked Flotel Francisco de Orellana, on the Napo. When the oil industry so despoiled that river's corridor that night skies glowed with light from natural-gas fires, the captain of the Flotel set out along the still-wild Aguarico, Ecuador's second-largest Amazon tributary, in search of new rivers and pristine forests. One day while prowling the weeds along the Rio Lagarto, he slipped into the Imuya lagoon. Ecotourism in Ecuador got a second chance to save the rain forest.

To keep the land granted by the government, settlers must clear at least a quarter of their property within the first year, so machetes, axes and chain saws chew through the forest.

But sadly, it seems the oil companies were not far behind.

Farther from Imuya, oil wells dot the western half of the Cuyabeno reserve. A typically South American arrangement grants one government Cabinet member dominion over the reserve and another dominion over the minerals and other resources beneath it. While the two wrangle, oil wells sprout.

Spills are potentially catastrophic to this vast but fragile ecosystem — and in Ecuador, earthquakes rupture pipelines with frightening regularity. The sense of environmentalism among Ecuadorean oil-well workers is such that when a bulldozer ruptured a pipeline recently, its quick-thinking operator created a berm to shunt the gushing oil into the Rio Aguarico.

Oil exploitation is but one of the immediate threats to the Ecuadorean Amazon. A greater source of harm is the settlers who stream into the forests along roads built by oil companies.

In Ecuador, thousands of desperate families move to the Amazon Basin each year, lured by hope and free land. The government promises 50 hectares (more than 100 acres) to all comers. To keep the land, settlers must clear at least a quarter of their new property within the first year, so their machetes, axes and chain saws chew hungrily through the forest. Valuable trees — mahogany and chanul, for example — are sold for lumber. Remaining vegetation is burned off before farmers plant crops or raise cattle.

Within a few years, rains and erosion wash away the thin layer of topsoil that is the departed jungle's only legacy. After that the land yields little, and the jungle shrinks a little more. And oases such as Imuya Camp become even more irreplaceable.

THE HARTFORD COURANT: Sunday, June 20, 1993

Handout #2 - Tourism: Conservation Boon or Bane?

Box 5.2 Nature tourism

Air-Tenere Reserve, Niger. This area has become an increasingly popular attraction for European and North American tourists who cross the desert in all-terrain vehicles. The wildlife of the reserve are a primary attraction for tourists and, thus, are economically important. The development of a locally based tourist industry is recognized by the project as a potentially important long-term development strategy that, if properly controlled, may be made compatible with conservation objectives. The project is attempting to promote increased local participation in the tourist industry, which is currently dominated by tour operators located in Agadez, about 300 kilometers south of the reserve. The project has cooperated with local artisans in establishing a center for displaying and selling local arts and crafts.

Annapurna Conservation Area project, Nepal. Since Nepal was opened to foreign visitors in the 1950s, tourism has expanded rapidly to become the country's top foreign exchange earner. More than 30,000 trekkers visit the spectacular Annapurna area each year (its permanent population is 40,000). The growth in the number of visitors has led to a proliferation of small tea shops and trekking lodges along the trails but has had a substantial negative impact on the natural environment. Large areas of forest have been cut to provide cooking, heating, and lodging for visitors.

An early goal of the conservation project was to increase the local economic benefits from tourism and to reduce the environmental impact of trekkers. Training courses for the owners of lodges and tea shops have upgraded the quality of service, standardized menus and prices, and improved standards of sanitation and waste disposal. These successes have greatly enhanced the status and influence of the project locally. To conserve energy in the conservation area, lodges and expeditions are now required to use kerosene, with fuelwood collection being limited to subsistence use. The conservation project has provided expertise, but not financing, for lodge owners to install back boilers (which heat recycled water during cooking to conserve energy) and solar panels. Lodge owners have also contributed to the cost of trail upgrading and maintenance.

The value of the economic benefits being accumulated by lodge owners has not been estimated but is clearly considerable by local standards and has dramatically increased the average per capita income. The use to which this surplus is being put has not been monitored. Some lodge owners have bought land in the nearest town, Pokhara, while others send their children to better schools in larger towns. In the villages on the major trekking routes, the incomes of about 100 to 150 families owning tea shops or lodges have significantly increased in the last decade. However, employment for nonfamily members appears to be very limited, and with the notable exception of some seasonal vegetables, most supplies are bought from Pokhara, many originating from outside Nepal. Some goods are purchased from traders who move up and down the trails, and employment for porters has undoubtedly increased because all goods must be carried by hand. But the significant local economic benefits from tourism have not been distributed widely either among or within villages.

An entry fee to the Annapurna Conservation Area has been collected from visitors since 1989. The 200 rupee (NR, $8) fee, which required government approval, is yielding an annual revenue of 4 million NR ($160,000)—equal to half the revenues from all of the trekking permits issued in Nepal, or more than 40 percent of the revenues from all of the national parks combined. The revenues collected pass directly to the Annapurna Conservation Area project.

Royal Chitwan National Park, Nepal. Chitwan has grown in importance as a tourist destination since the first wildlife safari lodge was established in 1965. Seven high-cost tourist lodges now have licenses to operate in the park, and more than forty small ones have sprung up outside. The park entry fee is now 250 NR ($9). Trained elephants are used to transport people around the park from both areas. The number of visitors has risen steadily and seems likely to continue to grow. Except for the annual grass collection (see box 4.4 in chapter 4), the benefits flowing from the park to local people are minor. In contrast to Nepal's Himalayan parks, local people are only marginally involved in tourism in Chitwan park. While traders benefit, most people face higher local prices as a result of tourism.

Khao Yai, Thailand. Khao Yai has become a premier tourist destination since its establishment in 1962 as Thailand's first national park. During the 1980s the park attracted 250,000 to 400,000 Thai and foreign visitors annually. These visitors spend an estimated 150 million baht ($5 million) each year on admission, lodging fees, transportation, food, and other services within the park; the annual budget for park management is 3.5 million baht ($120,000). Virtually none of the revenue goes to people living in the villages surrounding the park. The Sup Tai project, in Sup Tai village next to the park (see chapter 3), includes a small jungle trekking program for visitors. This program attracts several groups each year to Sup Tai village, but the economic benefits generated are modest, even for one village.

Monarch Butterfly Overwintering Reserves, Mexico. The spectacular display of the Monarch butterflies provides a unique nature tourism opportunity. The reserves received nearly 100,000 visitors in 1989. Yet only one of the five reserve areas is equipped for tourism. The facilities include an interpretive trail and visitor center, with the nearest community receiving the entrance fees to use for community projects. The community also benefits from sales and employment generated by a small store that Monarca, A.C., the nongovernmental organization implementing the project, helped establish in 1986. Women from the community have put up stands to sell food to tourists. In general, however, tourism to the area is unregulated and disorganized. Benefits to the local community are unevenly distributed and offer insufficient incentive to stop deforestation. As employment in the area continues to decline, the unrealized conservation value of tourism increases while the tiny reserves continue to be logged.

Volcanoes National Park, Rwanda. The park's mountain gorillas are the nation's main tourist attraction. Prior to the start of the tourism component of the project in 1979, the park received about 1,200 visitors annually. Visits increased to nearly 5,000 in 1983 and more than 10,000 in 1989. This increase, combined with an increase in gorilla viewing fees (from $5 to $200 per person), has led to a thirtyfold increase in tourism revenues. Project staff have habituated gorilla groups to human presence, permitting the animals to be closely approached by tourists. Current direct tourism revenue at the park is about $1 million annually. A proportion of the proceeds are returned to conservation in Rwanda but none goes to local people. The government has recently put significant pressure on the project to allow more visits to the gorillas to earn higher revenues.

Handout #3 - Tourism: Conservation Boon or Bane?

"The American Museum's Role in "Ecotourism"
by Susan Givens, Director and Penelope Bodry-Sanders, Education Coordinator
Discovery Cruises/Tours, American Museum of Natural History

In recent years, ''ecotourism'' has become one of the biggest booms to both the travel industry and global conservation efforts. Although the concept has been around for decades, ecotourism has become the buzzword of travel in the 90's, and is reported to be the fastest growing segment of the travel industry. With the increasing concern over the diminishing natural resources of our planet, it makes sense that we become ''green'' about the way we travel. Ecotourism attempts to use tourism to reconcile a delicate balance between economic growth and conservation of natural resources. The advantages are obvious -- it creates employment and income for local communities, helps promote appreciation of natural resources, and minimizes negative impact on fragile environments and ecosystems. And, in a recessionary time when leisure dollars are limited, ecotourism helps make people feel good about spending money. But as travel consumers, how can we be sure a tour labeled an ecotour is anything more than just marketing hype by tour operators trying to capitalize on this growing market? Moreover, with over 7 million Americans traveling last year alone to ecologically significant or endangered areas of the world, how can we be sure we are not doing more harm than good?

The concept of ecotourism is often confusing to both the industry and the traveler, as it leaves room for a wide range of interpretation. Despite efforts by environmentalists and the tourism industry to establish a set of guidelines outlining the essential components of an ecotour, few can agree on the standards and principles. Conservationists generally define ecotourism as travel that promotes conservation of natural resources. And indeed, tourism has proven to be a viable protector of many of the world's most precious resources.

Tourism dollars can be credited with helping to protect many endangered species, including the mountain gorillas in Rwanda and large tracts of diverse ecosystems in Costa Rica and Brazil. A more common application of ecotourism is the concept of ''responsible tourism'' -- tourism that is less likely to damage or disrupt natural or social resources while returning some of the economic benefits of tourism back to the local community.

The problems and faulty applications of ecotourism are many. Some tour operators believe a tour simply needs to include a visit to a nature reserve to be marketed as an ecotour. And, because in many countries government tourism offices are often connected to economic development agencies, potential revenue earned from ecotours often bypasses local communities, wildlife reserves and conservation efforts. Most ecotour operators subscribe to the philosophy that there should be a balance between the ecological, economic and social needs of the host country and the marketability of the ecotour product.

Achieving this balance has proven to be the most difficult aspect of the ecotourism movement. The vast majority of people still travel because they are seeking entertaining and relaxing diversions from home. They want adventure, without leaving all of the conveniences of home. Unfortunately, these objectives are often in conflict with responsible tourism principles.

Despite the pitfalls, converting tourism dollars into protection of natural resources is a viable concept. But what can consumers do to ensure their travel dollars are spent in an environmentally and culturally responsible way? Since the inception of the American Museum travel program more than 40 years ago, it has struggled with these very concerns. With a lack of standard industry guidelines, we have developed our own for Discovery Cruises-Tours to ensure responsible tourism toward both natural areas and indigenous cultures. The travel consumer can do the same by purchasing only those tours which have evident examples of responsible tourism. The following examples of American Museum's tourism principles will help the consumer identify what to look for in selecting a true ecotour.

Our staff at Discovery Cruises/Tours exerts economic pressure on the tour operators with whom we contract to handle travel logistics to insure responsible and ethical behavior toward local ecosystems and indigenous people. We monitor whether the operator respects the carrying capacity of the area and resists overbooking travelers into ecologically fragile areas-- even if larger numbers are permitted. Many countries are lax about monitoring the

Handout #3 - Tourism: Conservation Boon or Bane?

"The American Museum's Role in "Ecotourism" (continued)

impact of tourism. For instance, recently Ecuador tripled the number of tourists permitted to visit the fragile Galapagos Islands. Our Discovery Cruises/ Tours are strictly limited in the group size when it is determined or even suspected that larger numbers will eventually impact adversely on the environment.

- One of the basic principles of ecotourism is that the activity should involve the local population. When possible, we insist on paying for services in goods as opposed to dollars. When a Discovery Tour travels to an isolated island in the South Pacific, for example, reciprocity for hospitality is given in the form of books, school paper, pens or rice -- goods from which the entire community will benefit.

- Our Discovery Cruises/Tours strive to educate our travelers about areas of regional and environmental sensitivity. Too often when travelers meet indigenous people, it is a one-sided encounter where the local people "perform" for the visitors. It is equally important that tourists are accessible to the local people and engage in interactive dialogue, permitting them to question the visitors about their way of life. We are also careful to respect their wishes. For instance, when a council of Maasai elders asks that visitors do not give their children candy or pay young warriors for their photographs, we are obligated to respect this, in spite of how we may desire to act otherwise.

- We utilize and support local resources as much as possible. In recent years, remote Inuit villages in the Canadian Arctic have undergone a revival in traditional handicrafts due to increased tourism activity in the area. As local communities realize an economic advantage to selling locally-made handicrafts, ancient traditions are passed from community elders to young entrepreneurs.

- Perhaps the easiest way we can encourage responsible tourism is to insist on the proper disposal of garbage and removal of any imported items. The tour operators and cruise lines the Museum selects are carefully scrutinized to ensure that proper environmental standards are adhered to, and "nothing but footsteps are left behind."

Only through a continuous educational process and relentless self-evaluation can the American Museum and other ecotour operators promote travel programs that achieve their objectives while having little or no impact on the habitats through which they travel. From cross-cultural sensitivity to environmental preservation to waste disposal, the entire tour should serve as an opportunity for educating both visitors and natives about protecting natural and cultural resources. Developing a rewarding and effective ecotour requires critical thinking and a departure from standard tour industry practices. Without such thinking, the ecotour organizer and the travel consumer, no matter how well intentioned, contribute to the problems and not the solutions of protecting the earth's natural treasures.

Editor's Note: Discovery Cruises/Tours is the educational travel department of the American Museum of Natural History, which has been conducting tours to some of the world's most remote and wondrous places since 1953. Each program is led by a distinguished team of American Museum and guest lecturers.

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BIODIVERSITY: ALIEN SPECIES

Connections With the Curriculum

Social Studies: cultural dependence on products (i.e. pineapples, horses), history of disease
Environmental Studies: positive and negative effects of habitat alterations
Science: studying specific varieties and species
Language Arts: research, writing, verbal presentations

Teaching Level: Grades 6-12
Geographic Themes: Movement, Human-Environmental Interactions, Location, Place

Materials

Reference Map A - World Map (pg. 80)
Handout #1 - Accidentally Introduced Species
Handout #2 - Intentionally Introduced Species
Handout #3 - List of Additional Biological Invaders
Handout #4 - Articles from *Hartford Courant*, May 30 & 31, 1993, "Biological Invaders" by Steve Grant
Handout #5 - "The Woolly Adelgid"
"Aliens Among Us", *Nor'easter*, Vol. 4, No. 2, Fall/Winter 1992
Encyclopedias, Atlases
Butcher paper, tape, markers
Colored markers, pencils or crayons
Optional Supplemental Materials:
Seeds of Change materials

Objectives

Students are expected to:

- Apply geographic knowledge to an investigation of the physical movement of species
- Research and analyze case studies of several notable biological invaders, both accidental and intentional
- Appreciate the effects of importing exotic species to a new area
- Speculate on the consequences of accidentally or intentionally relocating species

Suggestions for Teaching the Lesson

1. Have students brainstorm a list of alien species they may have heard of and record the list on a large sheet of butcher paper (some they may know should include the gypsy moth, starlings, African killer bees, horses, chili peppers, AIDS virus). Save the sheet for #2 below.

2. Have students work in pairs or groups to list the impact upon the host environment each of the species from #1 above has had and whether the impact was positive, negative, or both.

3. Have students share their findings with the class. Record findings on butcher paper. Discuss why the impact of each species might have been negative or positive.

4. Distribute Handouts #1 and 2 and Reference Map A. Divide students into groups and assign two species from each list. Have each group map the origin of the species and the current location using different colored markers, pencils or crayons. Each group must also note how the species was introduced, how it travelled, and speculate on where it might move next. (Students should use Handouts 4 and 5, encyclopedias, or the articles listed above for additional information. Students must apply geographic knowledge (climate, waterways, etc.)

to speculate on future movement of alien species.

5. Distribute Handout #3. Have students select one of the species listed for a research project and presentation. You may wish to have students work in groups or as individuals. Have students research the questions listed on Handout #3.

6. Have students make class presentations on their research and discuss the case studies in class.

7. Have students brainstorm ideas on how to control the spread of alien species.

EXTENDING THE LESSON

In a creative exercise, have students speculate on the biological implications of space travel and the transportation of planetary biological items.

Pam Benn, Clark Lane Middle School

Handout 1 - Biodiversity: Alien Species

Some accidental biological invaders

Species	Where from	Impact	Found in Connecticut?
Asian tiger mosquito	Northern Asia	Capable of carrying deadly disease	No, but expected
Dutch elm disease	Holland	Has destroyed most American elm trees in eastern U.S.	Yes
Common pine shoot beetle	Europe	New insect invader is damaging Christmas tree plantations in Ohio	No
Chestnut blight	Asia	Kills chestnut trees	Yes
Fire ant	Brazil or Argentina	Stings people	No, and not expected
Periwinkle	Europe	Abundant coastal mollusk, undoubtedly displaces other native species	Yes
Dead man's fingers	Japan, via Europe	Marine plant believed to have damaged Long Island Sound scallop fisheries	Yes
Asian sasequirt	Asia, via Europe	A leathery marine animal that affixes itself to boat hulls and underwater structures. Has taken over mussel habitat in Long Island Sound	Yes

Handout 2 - Biodiversity: Alien Species

Some biological invaders introduced intentionally

Species	Where from	Impact	Found in Connecticut?
European gypsy moth	Europe	Has defoliated up to 12 million acres of forest in a single year in Eastern U.S.	Yes
Melaleuca tree	Australia and Malaysia	Invading Florida Everglades, destroying native wetlands	No. Not expected
Brazilian pepper tree	South America	Invading South Florida, overwhelming native plants	No. Not expected
European starling	Europe	Huge flocks foul urban areas with droppings	Yes
Purple loosestrife	Europe	Wetland plant crowds out native plants ducks feed upon	Yes
Garlic mustard	northern Europe	Invades forests, appears to displace native wildflowers	Yes
Common carp	Eurasia	Eats eggs of native fish, pulls up vegetation, dirties rivers	Yes
Walking catfish	Southeast Asia	Displaces native species	No. Not expected
African "killer" bee	Africa, by way of South America	Notorious stinging bee	No. Not expected
Kudzu vine	Asia	Invades old agricultural land, creates biological desert	Yes. Recent arrival
Asiatic bittersweet	Asia	Chokes trees	Yes

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Handout 3 - Biodiversity: Alien Species

Additional Biological Invaders

Below is a list of alien species. Select one species to research.

Zebra mussels (dreissena polymorpha)
Asian clams (corbicula fluminea)
Japanese seaweed (antithamnia nipponicum)
Brown seaweed (sargassum muticum)
Japanese shore crab (hemigrapsus sanguineus)
European bryozoon (membranipora membranancea)
European nudibranch
Alewife
Ruffle
White Perch
Lamprey Eel
Hemlock Wooly adelgid (tsuga canadensis)
Ring-necked pheasant
Gray partridge
Chukar
House sparrow

RESEARCH QUESTIONS

1. Identify the species - what is it.

2. Where did it originate? Mark on a world map the location of the origin of the species. Note the conditions in the home environment which make it possible for the species to thrive.

3. Where is it found now? Mark on a world map the current location(s) of the species. Note the environmental conditions that allow it to thrive in its new location(s).

4. How did it arrive in the new locations? Indicate method and route of travel on a world map.

5. Was the species introduced accidentally or intentionally? If introduced intentionally, what was the original purpose for introducing it to its new environment?

6. What impact, positive or negative, has the alien species had on the environment? Has this had an effect on the human inhabitants of the new environment? If so, what effect?

7. Speculate on future movement of the species, if any. Note conditions which make future movement possible or impossible.

8. What steps, if any, have been taken to control the movement of this species?

Handout 4 - Biodiversity: Alien Species

Stowaway species taking their toll on life, property

■ The fingernail-sized zebra mussels, which originally came from Asia, have spread south and east from the Great Lakes and are poised to move into New England.

Biological INVADERS

A growing environmental threat

FIRST OF TWO PARTS

By STEVE GRANT
Courant Staff Writer

Sometime in the mid-1980s, a crane on the docks in Houston lifted a 20-ton container off a cargo ship and lowered it onto U.S. soil.

Inside the sealed bin were tires from Asia destined for a retreading plant. Also inside, unnoticed, were the eggs of a dangerous stowaway — the Asian tiger mosquito.

Not long after, a ship arriving in western Lake Erie or adjoining Lake St. Claire dumped the millions of gallons of ballast water it had sucked in at its port of origin, probably the Black Sea.

Washed out with the ballast were the larvae of a fingernail-sized clam called the zebra mussel.

Today, the Asian tiger mosquito, an aggressive biter capable of spreading disease more quickly than many of its native cousins, is breeding all over the South and likely will be in Connecticut before long. Zebra mussels, which cluster by the thousands inside utility pipes and under boat hulls, have spread throughout the Great Lakes, the Mississippi, the St. Lawrence Seaway and into the Hudson River, and are now poised to move into New England.

The two invaders have joined a growing list of non-native plants and animals that slip into the United States and enjoy a population explosion, far away from the natural predators that ordinarily keep their numbers in check at home.

Some non-native species, such as the Asian tiger mosquito, which can carry Eastern equine encephalitis, threaten public health. Others, such as the zebra mussel, damage public and private property. Still others, such as the many non-native plants proliferating in the wild, can destroy the native landscape.

Scientists say the problem seems to be getting worse, almost certainly because of the increasing speed and changing nature of international trade.

"A new invasion comes across my desk about every 90 days," said James T. Carlton, a marine scientist who hears regularly from researchers around the nation.

Carlton, director of the Maritime Studies Program of Williams Col-

lege-Mystic Seaport at Mystic, is one of 25 scientists who sent a letter in March to Vice President Al Gore urging the federal government to get serious about combating the introduction and spread of non-native species.

Many scientists have begun to refer to these organisms as "biological pollutants," because of the harm they do. But unlike chemical pollutants, which break down over time, these pollutants destroy ever more as they spread.

Many non-native species have been doing damage for decades. In the Eastern United States, the gypsy moth caterpillar, an insect of European origin, defoliates millions of acres of forest in a single year. Dutch elm disease, a fungus that originated in Europe, wiped out the elms that once adorned roadsides and town squares.

Some species originally were brought in deliberately and innocently, for gardens, aquariums or other purposes. But many, such as the Asian tiger mosquito and the zebra mussel, have been introduced accidentally.

And the growing number of accidental introductions of non-native species worry many scientists.

World shipping has made such introductions more likely. Until the last few decades, goods were shipped in a variety of crates, boxes and other containers. But large boxcarlike shipping containers have now become nearly universal, eliminating much loading and reloading of cargo at ports and rail yards.

These sealed containers, which can travel by boat, truck and rail, amount to a safe shelter. Not only can an alien species reach a port city, but also it can ride far into the interior of the United States, where the environment may be more suitable than the coast.

Non-native species also are more likely to survive long trips because they spend less time in transit. Many commodities are now shipped by air freight, and others by supertankers that move quickly from one part of the world to another. And, increased trade between North America and places such as Russia and China raises the possibility of entirely new sources of species.

Another factor appears to be changing water quality. Pollution-tolerant plants or animals now may overwhelm the native species. Conversely, bodies of water once polluted but now cleaner, like many U.S. rivers and some foreign ports, may now be able to sustain organisms that once would have perished in the pollution. One reason the zebra mussel did not show up in this country many years ago may be because it didn't have a chance to; some European ports used to be so polluted the mussels couldn't survive.

And there is the possibility that scientists may simply be more alert to new species now. "It may be that as soon as you raise the flag on an issue you see more," said Carlton.

Since the arrival of the zebra mussel and the Asian tiger mosquito, the government has begun to tighten its defenses against non-native problem species.

Ballast water no longer can be dumped in the Great Lakes, and tires from Asia now must be treated before shipping to kill mosquito larvae.

But responsibility among agencies is sometimes fuzzy at best, scientists say, and the money to do anything — to move quickly to wipe out an accidental introduction of some insect, for example — often isn't there. Congress has ordered a federal study of the problem, seeking ways to prevent pests from reaching U.S. soil.

"I don't think there is anybody who thinks the government is doing a good job," said Faith Thompson Campbell, senior research associate with the Natural Resources Defense Council, a private environmental group.

Speeding up nature

Over the centuries, without any help from humans, many species of plants and animals have migrated from their places of origin — slowly spreading as climate has changed or helped by a storm that blew a seed or small organism hundreds of miles.

For example, the cattle egret, an African bird that feeds in open land with grazing animals, showed up in South America, then North America, working its way north wherever it found favorable habitat. Cattle egrets are occasionally seen in Connecticut now. They are not a problem.

Mangroves, which are varieties of trees, have over the centuries expanded their range throughout the world's tropical and sub-tropical regions because their seeds float and can be carried by the seas.

What concerns scientists today is that the natural ebb and flow of life on Earth has become grotesquely distorted by industrialization. Plants and animals are now plucked from one place and plunked down in another, a continent or more away, where they can suddenly and radically alter the environment. In effect, the world is being homogenized in a hurry.

"Not only are we hastening this whole process, but we're skewing it in favor of organisms that do best in human-induced landscapes," said Bruce E. Coblentz, a professor of wildlife ecology at Oregon State University in Corvallis. "And most often those are the organisms we don't want around in any great numbers. We're favoring the pests."

One troubling characteristic of these invasions is that they invariably come at the expense of native species, sometimes driving some other North American plant or animal to extinction, or to the brink of extinction.

A non-native plant or animal may seem fine, maybe seem even prettier or more valuable than the plant or animal it is displacing. But scientists say the newcomers can crowd out other species and strip an area of its biological diversity.

Richard N. Mack, chairman of the botany department at Washington State University in Pullman, and an authority on the changes in ecosystems, says non-native plants constitute the majority of weed problems for farmers. Perhaps 90 percent of the weeds that inhibit agriculture are non-native, he said.

"We lose probably as much as one-fourth of the total agricultural production in this country in terms of the value of those products due to these species," he said.

"The cost of our food has a component in it reflecting a combination of the herbicides we used to combat these species, plus the amount lost to these species. If a farmer should have been able to raise 2 tons on an acre and only gets 1.7 because of pests, then we are paying for that loss."

The jarring introductions began long ago. The early European explorers and settlers inadvertently brought many non-native species with them, including the rat and crabgrass. The alien blight that wiped out the American chestnut, the single most valuable tree in the East, was first discovered 89 years ago in New York. Scientists suspect it arrived on Asian chestnut trees shipped to American horticulturalists.

Though there is no argument that alien species have caused problems, scientists disagree on the severity of the problem and what should be done about it.

"Let's not be purists about it," said R. D. Henry, an associate professor of biological sciences at Western Illinois University in Macomb. "Let's moderate our thinking to include them [non-natives] as necessary." Henry said he agrees with other scientists that non-native pests must be held to a minimum, but he said he doubts scientists can stop them from spreading once they are here.

"I just don't see how they are going to win the battle," he said.

'Cops on the corner'

Scientists who work with the pests agree something must be done.

In the March letter to Gore, some of the most renowned biologists and botanists in the country pleaded for action, saying that present efforts are "costly, piecemeal and ultimately futile."

"It is imperative that an effective national program be created to prevent the importation of harmful alien species; eradicate or contain new infestations; and provide sufficient funds for research into control and management of the most aggressive alien species that are already established," they wrote.

Carlton, of Mystic, believes one serious problem could be alleviated comparatively easily — require all ships to change their ballast water at sea, not just those bound for the Great Lakes. Any organisms in the ballast likely would perish at sea.

"At least two million gallons of ballast water are released every hour in the United States, on the average," he said. "It's ecological roulette — you never know what is going to take."

The federal government has a series of programs in place to exclude non-native species, though it makes no claims to catch every potential pest.

"We're kind of like the cop on the corner," said Michael J. Shannon, an assistant director of the USDA's Animal and Plant Health Inspection Service, which inspects ship, rail and truck freight and even uses dogs to sniff out contraband.

"In spite of all this, pests do come through the network and get established."

The major regulations governing alien species rest with the U.S. Department of Agriculture and the U.S. Fish and Wildlife Service, but many other agencies have bits and pieces of responsibility.

Over the years, conservation biologists have identified what they see as a series of major failings in the federal system. One problem, they say, is that the government has been slow to add to its list of pests that are not allowed in the country.

There may be as many as 600 plants that could be added to the Federal Noxious Weed Act, the scientists say. The same could be done with fish, or marine organisms in general, they say.

Scientists are not calling for an outright ban on all things foreign. "Absolutely not," said Howard M. Singletary Jr., director of the plant industry division of the North Carolina Department of Agriculture. "Exotic plant species are the very foundation of agriculture and horticulture in the U.S. today."

Rather, the scientists are urging that controls be imposed to block those organisms that most likely could cause problems because, for example, they already have proved pests in other parts of the world.

Another major problem, critics say, is that the USDA has clear authority to guard against introductions of pests that would affect crops or commercial forests — but no such mandate to block pests that could ravage the natural landscape.

Yet another weakness is interstate commerce. Once an exotic is here, there is little to prevent its spread from one state to another, wittingly or unwittingly. Though critics disagree strenuously, the agriculture department argues that can regulate interstate transport of pest species only when it has an active quarantine program in place.

Singletary said the law should be changed to make clear that a pest cannot be knowingly moved from one state to another.

Also, there are suggestions for a quick-response team that would be able to move quickly to eradicate any pest that managed to slip into the country.

One of the reasons the Asian tiger mosquito managed to get so entrenched in Florida, and the rest of the country, is because the federal government was so slow to act to stop its spread, argues George B. Craig, a professor and mosquito specialist at the University of Notre Dame.

Craig said that 24 scientific societies urged James O. Mason, then director of the federal Centers for Disease Control, to move quickly to try to eradicate the Asian tiger mosquito. "There was a unanimous sense of urgency in the medical-entomology community," Craig said.

Mason, however, said his advisors questioned whether a major campaign would have been worth it. It appeared the mosquito already had spread in the U.S. — and even if it hadn't, it was becoming well-enough established in the western hemisphere that it eventually would have arrived anyway, he said.

"If we had felt the threat was of great enough enormity, and the White House and Congress had gone along, more could have been done — at very significant cost," Mason said. "And the question then is, would we have succeeded?"

In 1988, the government specified that all shipments of tires from the Orient had to be treated before shipping to ensure they would be free of mosquito larvae. The agency now spotchecks about 20 percent of tire shipments. Officials say that of the first shipments checked, perhaps less than 100 in all, 25 percent had not been properly treated.

"There was no effort made to try and prevent this mosquito from spreading," Craig said. "We just let her rip.

"As a result, it is in places like Chicago and Indianapolis and Baltimore. It's just thriving, doing very well. I don't know if we could have stopped it — but we never tried."

Slipping through

In a screened-in laboratory at Florida Atlantic University in Boca Raton, medical entomologist Sally L. Paulson fights on one front of the war.

Paulson is trying to determine whether the Asian tiger mosquito is displacing another less-bothersome mosquito, as circumstantial evidence suggests. The Aedes aegypti mosquito has been disappearing as the Asian tiger mosquito has been spreading.

In her lab are hundreds of plastic cups, sealed with netting, in which mosquito larvae of both species are cultured. At a nearby table, undergraduate biology majors painstakingly pick apart the larvae, searching for evidence of a parasite.

Paulson has determined that a parasite that ordinarily attacks the aegypti mosquito has no effect on the Asian tiger mosquito. On the other hand, a parasite that ordinarily attacks the Asian tiger mosquito "is devastating to aegypti," she said.

The concern is that, of the two, the Asian tiger mosquito is "a more avid manbiter," she said, and that it can carry Eastern equine encephalitis, a rare but often fatal brain disease.

"I want to avoid being unnecessarily alarmist," Paulson said. "But we do have a lot of question marks."

During June 1991, researchers found the Eastern equine encephalitis virus in Asian tiger mosquitoes taken from a tire dump not far from Walt Disney World in Florida. The dump has since been destroyed, but concern within the scientific community continues.

"We feel the biggest problem in the United States is in tire dumps with large numbers of used tire casings," said Carl J. Mitchell, chief of the medical entomology and ecology branch at the Centers for Disease Control in Fort Collins, Colo. "But it can breed in the back yard, bird baths, flower pots, possibly rain gutters. Practically any container that accumulates some standing water."

There is no longer any hope that the Asian tiger mosquito can be eliminated from the nation's landscape.

In Florida, its spread was quick. At the Pasco County Mosquito Control District in New Port Richey, for example, every known appearance of the Asian tiger mosquito over the last two years was tracked with red pins on a huge wall map. There are pins all over the map.

"From one season to the next, we had it everywhere," supervisor Kim R. Feagley said.

Because non-native species are so often troublesome, research on the subject is burgeoning. At an old missile base in Ansonia, scientists with the U.S. Forest Service are studying the life cycle and reproductive abilities of the Asian gypsy moth. The specimens are kept in a laboratory with negative air pressure, so organisms inside cannot easily slip out.

The Asian gypsy moth was discovered in the Pacific Northwest in 1991, having arrived on a Russian cargo ship, sending a shock through the forestry community.

More than a century ago, a European-origin gypsy moth was imported into Massachusetts by a French entomologist seeking a silk moth that could survive in the United States. Several of the moths escaped, and ever since, the species periodically has ravaged vast expanses of Eastern forest.

Scientists are worried that the Asian gypsy moth could spread quickly because, unlike its European cousin, the female of the species can fly.

So as soon as the Asian gypsy moth was detected, the U.S. Forest Service moved to eradicate it from nearly 120,000 wooded acres in Washington and Oregon. The effort, which involved the spraying of a biological pesticide from helicopters, appears to have succeeded.

"This is a case where they did the job," said John D. Lattin, a professor of entomology at Oregon State University. "They acted with dispatch, and apparently with successful results."

In Ansonia, the forest service is studying what would happen if the two gypsy moths interbred, as it has already determined they can do.

William E. Wallner, the agency's chief Asian gypsy moth researcher, said he's already learned enough to reach one conclusion:

"Once something like that becomes established," Wallner said, "it is very difficult to contain."

Cost of control

Containment is not only difficult, but expensive.

In the case of the zebra mussel, utilities in the Midwest were forced to spend millions to unclog pipes suddenly encrusted with the little mussels. One rough estimate suggests the mussels might do between $400 million and $500 million a year in damage to pipes, docks, boats and other property over the next decade.

Those mussels have drawn more attention to the non-native issue than any other non-native pest. In Connecticut, Northeast Utilities has been watching for the mussels for two years, installing underwater collecting stations near its power plants as a way to monitor their arrival, which the utility assumes is inevitable.

Virtually every state in the country spends money for some kind of non-native species control. Millions are spent yearly on the European gypsy moth alone.

Don C. Schmitz, a biologist with Florida's Department of Natural Resources, said that since 1980, Florida alone has spent $140 million trying to control non-native species. While the results have been reasonably good in waterways, "The terrible thing about it is, we're still losing the battle in Florida's wetlands and upland forests," he said.

Especially vulnerable are many of the nation's nature preserves, which often were set aside at great public and private expense.

"We have spent billions to preserve these lands in the United States for future generations, yet the invasions by exotics are destroying this heritage," Schmitz said.

The Nature Conservancy, which has preserved more than 6.9 million acres of land in the United States, recently appointed John Randall as its first non-native weed specialist, or, as he is often called, its weed czar. "The thing that has impressed me in this job is how many weeds there are, and how few areas of the county don't have severe problems," he said.

The national park system alone is spending $10.8 million to control non-native species during the next four years. The work will include pulling up plants by the roots, building fences to keep out non-native animals, and sending electric shocks into ponds and streams to stun and remove non-native fish.

But the service estimates that much more would have to be spent — $51 million — just to address the problems it already knows about.

Already, the zebra mussel has prompted changes in the ways some ships discharge their ballast water. It was the principle reason for the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. The act, which took effect earlier this month, requires ships bound for the Great Lakes to dump any ballast water from foreign ports while underway, and replace it on the high seas. Water from the middle of the ocean is less likely to contain organisms that could survive in coastal waters.

Not all the pests come uninvited

Species imported to benefit man can be a menace to established life

By STEVE GRANT
Courant Staff Writer

HOMESTEAD, Fla. — In an expanse of Everglades National Park a few miles from this hurricane-ravaged city, the landscape in every direction is thick with a short, bushy tree. Hurricane Andrew flattened most everything else, but not the Brazilian pepper.

Brazilian pepper was imported from South America in the 19th century because it was pretty. People planted it around their homes and along streets. Some called it "Florida holly," or "Christmas berry" because it has red berries in winter.

Before long, it didn't matter whether anybody planted it or not. It was spreading into the wild on its own. Taking advantage of any disturbance of the soil, whether by bulldozer or nature, it began to overwhelm south Florida's native plants, at least in part because of its tremendous reproductive success; a far greater percentage of its seedlings survive the rigors of the wild.

Now, the Brazilian pepper is one of the most serious pests in south Florida. A relative of poison ivy, it can cause a rash. Birds can get intoxicated on the berries.

"The biological natural resources are the reason for this park," said Robert F. Doren, the assistant research director of Everglades National Park. "But easily in one person's lifetime we could lose a national park if we didn't do anything," he said, standing amid nearly 5,000 acres of Brazilian pepper.

In addition to the plants and animals that slip into the United States accidentally, such as the Asian tiger mosquito, there are species brought in on purpose, only to become pests. This is another dimension to the biological pollution problem.

These intentionally introduced species are not spread about with quite the abandon of a century ago. But even today, to the dismay of a growing number of scientists, people give the red-carpet treatment to potentially troublesome plants, animals or fish.

"There will be continuing problems unless we can develop a strict national policy," said Bruce Coblentz, a professor of wildlife ecology at Oregon State University. "For whatever reasons, there are are always people who view an organism, something we don't have, as potentially better than what we do have. I call that the 'grass is greener' philosophy."

Scientists often cringe when they consider the innocent way in which a new species was introduced years ago.

Brazilian pepper came into the United States without any fuss. Its success here is traced to 1898, when three packets of seeds were shipped to Florida from South America. People happily went about planting it for decades.

Melaleuca, another big pest in Florida, is a tree native to Australia and Malaysia. Because it sucks up a great deal of water, it was planted in the early years of the century as part of a scheme to dry up the Everglades, in hopes they would become developable and mosquito-free. In the 1930s, to hasten its spread, melaleuca seeds were dropped from an airplane flying back and forth over the Everglades. Nobody complained.

Then there is the walking catfish, brought to Florida from southeast Asia as a new aquarium fish. Its escape into the wild is a practically slapstick example of how non-native species get loose — the fish literally fell off a truck.

Biological desert

A cruel characteristic of many non-native species is an ability to take advantage of any opportunity.

In the Everglades, where the land once had been farmed and then left to revert to nature, it was the Brazilian pepper, not the native sawgrass, that sprouted on the open land.

Where Hurricane Andrew sheared the leafy tops from the pockets of trees that dot the Everglades, scientists now fear the worst — Brazilian pepper seeds will get the light they need to sprout and crowd out the native hardwoods that help make the area distinctive.

Where the Brazilian pepper has taken hold, scientists have found that the number of surrounding plant and animal species drops dramatically, often in half. "It's kind of like a biological desert," said Don C. Schmitz, an aquatic biologist with Florida's Department of Natural Resources.

Like the Brazilian pepper, melaleuca long ago wore out its welcome. Not only does it grow in thick stands that choke out other plant and animal life, its leaves contain an oil that, when exposed to flame, can cause a tree to explode in a ball of fire.

Melaleuca now dominates about 500,000 acres of land in south Florida, and it is spreading at an average rate of 50 acres a day. Doren says the park needs about $300,000 to control the tree over the next five or six years. Even then, he believes, a major effort to come up with some kind of natural biological control — some natural predator or condition that will keep it in check — is mandatory if the tree is to be brought under control in Florida.

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"The Everglades are a classic example of an area being completely transformed by alien species," says Richard N. Mack, chairman of the botany department at Washington State University in Pullman, and an authority on the changes in ecosystems.

The walking catfish is found throughout south Florida today. Walter R. Courtenay Jr., a professor of zoology at Florida Atlantic University and an authority on non-native fish, said a fish farmer once told him how it got loose.

In the late 1960s, Courtenay related, the fish farmer, from Miami, placed a load of 400 walking catfish in Styrofoam boxes in the back of a rusty old van and drove up U.S. 441 about 50 miles to Parkland. Along the way the fish sloshed about in the back of the van so much that at one point a catfish flopped into the cab and lodged itself under the accelerator pedal.

At Pompano Beach, about 35 miles from Miami, the farmer stopped and checked the load. Perhaps 10 percent of the fish were left. The rest had flipped out the back of the van because the door was either open, or had rusted off.

"He claims he left a trail of walking catfish," Courtenay said. Parallel to U.S. 441 is a canal, connected to other canals. Not long after, walking catfish were discovered in them.

Since then, the catfish sometimes climb from the canals, cross highways and stop traffic. "We've had to close roads," Courtenay said. The catfish also crawl from the canals to visit nearby fish farms, where they devour other fish raised for the pet shop trade.

"I call it poetic justice, myself," Courtenay said.

The wonder fish

Of course, many plants and animals intentionally brought into the country from abroad have been beneficial. Onions and peaches, cows and pigs, and many flowers and trees are among them.

But, scientists note, the cultivated plants and domestic animals are different. They are not truly wild creatures. In fact, they often require a coddling hand to survive.

"They are so far removed, genetically, from their ancestors, that they require cultivation by humans and typically cannot make it on their own in the wild," Courtenay said.

"But when you bring in a fish from outside the country, you bring in something wild that does not require our care. Once it is introduced, it will do whatever it pleases."

Some deliberately introduced species have permanently altered the nation's landscape and waters.

A century ago, Spencer Fullerton Baird, an esteemed zoologist who was the first U.S. commissioner of fish and fisheries and an early secretary of the Smithsonian Institution, was practically cheered when he imported carp.

It seemed to make good sense. The carp was one of Eurasia's popular food fishes, so why couldn't it be used to feed millions of Americans? Congressmen clamored for shipments of the new "wonder fish" to dump into rivers and lakes back home. Using special railroad cars, the government delivered live carp throughout the country.

At the time, introductions of foreign plants and animals were rife; "acclimitization" societies happily devoted themselves to such introductions.

The carp did what people wanted, adapting to the nation's rivers and lakes throughout the continental United States, reproducing abundantly in the wild. Today it is a huge nuisance, eating the eggs of native fishes, yanking up aquatic vegetation and dirtying rivers throughout the continent. A comparatively small number of people fish for it and eat it.

"I think it probably has been the most devastating aquatic organism ever to get into North American waters," said Coblentz.

The European starling was brought into the United States by a society devoted to introducing all the birds Shakespeare mentioned in his works. Among the most numerous birds in the country, it is a major pest in many areas and will never be eradicated.

Plants such as purple loosestrife, imported because of its pretty spikes of purple flowers, are choking out native vegetation that wildlife need to survive, spreading through wetlands in much of the country.

Kudzu, a vine, has strangled trees throughout the South for decades and, recently, has even shown up in New Haven, where botanists are eyeing it warily to see if it will prove as troublesome in a colder climate. Multiflora rose, a shrub that the government once promoted, now is officially banned in many eastern states because it is smothering pastureland.

Scientists say that people just don't realize the problems non-native species can cause in a new environment. Often, for example, people unwittingly worsen a pest problem by planting something that already is proving to be a pest.

"I'm sure they wouldn't do it if they had the foggiest," says Faith Thompson Campbell, senior research associate with the Natural Resources Defense Council, a private environmental group. "But that's the problem. We don't have a system for forcing them to be aware of it."

Chesapeake oysters

Scientists themselves sometimes bring exotics into the country — to use as natural predators on pest species that have become established, a method called biological control. But those importations now come only after extensive study and field work intended to reduce to a minimum any chance the new creature will itself prove to be a pest.

Other plants and animals may be regarded as potential pests by some, and not by others.

In South Carolina, state game officials and federal forestry officials have planted the sawtooth oak, an Asian species that produces prodigious quantities of nuts. The idea is to help the wild game in the area flourish. But ecologists are uneasy, especially with a tree whose supposed virtue is its ability to produce lots of seeds.

Perhaps the best example of how contentious the issue can be is the debate over a proposal to seed a new kind of oyster in Chesapeake Bay.

Some of the watermen who work the bay harvesting the blue crab and the Eastern oyster are clamoring to introduce the Japanese oyster — legally — as has been done in other parts of the world, including the Pacific Northwest. They believe it will be more resistant to two diseases that are killing the native oysters.

But Maryland authorities are opposed, as is the Natural Resources Defense Council. In essence, the question is whether the Japanese oyster will prove to be cow or kudzu.

Fred Garrett III of Virginia, who plants seed oysters in the bay and harvests them at maturity, is one who would like to see the foreign oyster introduced. Only 88,000 bushels of oysters were harvested in Virginia this year, down from the 10 million once gathered. "It is not very hard to see what we need," he says.

"We're all asking, but it's not doing any good," Garrett said.

But scientists, for the most part, are skittish about the idea. They say the bay's native oyster population crashed because of diseases, but also because of decades of overfishing.

"When these things happen, people are prone to look for quick fixes, rather than do what they should have been doing all along — and has been recommended for more than 100 years — reduce the harvest pressure," said William J. Hargis Jr., professor emeritus of the school of marine science, College of William and Mary, and former director of its Virginia Institute of Marine Sciences.

Hargis believes that by limiting access to oyster reefs, which have been damaged over time by heavy fishing, and a selective breeding program that culls out the fastest-growing and most disease-resistant oysters, the native oyster could come back in the bay.

"It is the oyster that evolved in the Chesapeake Bay and is best suited for the Chesapeake Bay," he said. "If you can by appropriate measures use native oysters to bring about a restoration, that is the way you should go."

At the moment, a proposal to introduce a small number of sterile Japanese oysters — they could not reproduce in the wild — is pending. The idea is to see if the Japanese oysters are in fact more disease resistant. Dennis L. Taylor, dean and director of the Virginia Institute of Marine Sciences, is expected to decide on that proposal any day.

But some people don't want to wait. Rumors recently spread about one oysterman who supposedly dumped several hundred Japanese oysters into Chesapeake Bay to see if they might flourish. The police were called.

"We went right to the source and confronted him with it," said Robert J. Markland, chief enforcement officer for the Virginia Marine Patrol. "And when confronted he said it wasn't so. We couldn't find any witnesses to verify whether he put them overboard or not."

Industry cautious

As the issue has begun to attract more attention, government action — and calls for action — have increased.

As part of a federal law passed in 1990 in the wake of the zebra mussel invasion, the U.S. Fish and Wildlife Service was asked to report back to Congress with recommendations on how to prevent the intentional introduction of harmful species.

Those recommendations are due any day, and reflect work of a committee that included representatives from various industries that import exotics, including pet shops, nurseries and aquaculture operations.

"Options ranged from 'ban them all' to 'let everything in,' " said Sharon K. Gross, the service's coordinator for its aquatic nuisance species task force. The recommendations are expected to call for additional controls to lessen risks.

An advisory committee of scientists and industry representatives also has been advising the U.S. Congress's Office of Technology Assessment in a study of the issue it is conducting.

"From the industry point of view, 'Yes there are a few woody plant species brought in that are pests,' " said William Flemer III, vice president of Princeton Nurseries in Princeton, N.J., and a member of that panel. "But we don't want to throw out the baby with the bath water."

Exotic tree species are almost the only trees that will flourish in the harsh conditions of U.S. cities, Flemer said. Cities, he noted, "are not a natural environment."

"I argued for not being too extreme," he said.

One improvement that already has been suggested by some of the scientists would be to watch closely for those species that they highly suspect could cause problems. The idea is not to ban the importation of all plants and animals, but to ensure that those that could harm the environment don't get in.

"There are species around the world we know we don't want in the United States," Courtenay said. Scientists are able to identify likely problem species by looking for organisms that have proved troublesome when introduced elsewhere in the world, and by identifying families of plants or animals that often prove troublesome.

Affected industries are urging caution in any new controls. They believe nonnative species should be subject to a screening process before importation — but not a lengthy and costly one. And they prefer that any prohibitions be imposed only in those states where the species could be a problem. Also, species that have been imported over the years without incident should not have to undergo review, they say.

"We have to make sure we don't overreact to those very serious threats and overregulate those activities which are easy to identify and regulate, merely to show an accomplishment," said Marshall Meyers, executive vice president and general counsel of the Pet Industry Joint Advisory Council, a private Washington, D. C.-based group that represents the pet industry.

"It would be nice to return to pre-Columbian times, but that really is not going to happen, when we look at the way the world operates today," Meyers said.

Ignoring the list

It was the pet industry that smothered one earlier effort at better control.

During the early 1970s, Courtenay and a group of scientific colleagues provided the U.S. Fish and Wildlife Service with a list of about 30 foreign fish species that they strongly suspected would cause problems if they escaped or were released in U.S. waters.

The Fish and Wildlife Service moved to ban those species, but the pet industry threatened to file a lawsuit. "They backed off, and that was that," Courtenay said.

James A. McCann, a senior scientist with the agency's National Fisheries Research Center in Gainesville, Fla., remembers the issue. "We handled it badly," he conceded.

Among the fish on the list were the blue tilapia and the peacock cichlid, both identified as possible threats to the environment. The blue tilapia is now the dominant fish in the lower Rio Grande; the peacock cichlid is loose in waterways south of Miami.

Said Courtenay: "We keep making the same mistakes over and over again."

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Handout 5 - Biodiversity: Alien Species

Hemlock Woolly Adelgid
Clinton Conservation Land Trust Annual Report, 1992

The hemlock woolly adelgid, first introduced into the United States in the Philadelphia area 15-20 years ago is a serious pest of eastern hemlock, Tsuga canadensis, in several Northeastern states. In the eight years it has been in Connecticut, having arrived here earlier than it would have without Hurricane Gloria, it has caused many individual trees as well as acres of forest to die.

The adelgid is a type of aphid which feeds on the young twigs of trees by inserting its piercing and sucking mouthparts and removing sap. This action causes the cessation of growth, premature needle drop, dieback of branches, and the death of the tree. In some cases, a heavy infestation of the aphid coupled with a short term lack of water will rapidly cause decline of the tree. A drought of as little as 20 days in hot weather can kill an infested tree in one year.

The most obvious evidence of a hemlock woolly adelgid infestation is the cottony egg sacs produced by the aphids as protection. This cottony mass will remain throughout the year, even after insect control measures have been instituted. although it does begin to decompose following spraying.

Female adelgids live over the winter, laying their eggs from early March through June. Each female lays about 50 eggs within a single egg sac and then dies. The eggs begin to hatch in early April through June. Newly hatched nymphs or crawlers are very small, settling on the young twigs where they feed and mature within a couple of weeks. Some of these become adults and produce a second generation on the same tree, while others grow wings and search for more hemlocks. Crawlers of the second generation migrate to the new twigs in July, where they become inactive until mid-October when feeding and development resumes. Nymphs mature into adults by winter and thereby complete the life cycle on hemlock.

Many substances have been found to control this insect if applied correctly, usually twice during the growing season. Horticultural oil, the safest and most environmentally sound material, works as well as any, but it must be heavily applied. It thus becomes expensive to control this persistent insect on the trees, only to have it return sometirne from afar to begin the cycle once again. Spraying can eliminate the damage from this insect, but not the insect itself.

In the Peter's Woods area, it has taken about four years for the hemlocks to become infested and die from damage done by this insect. The fact that these trees were under stress from three summer droughts in the past five years probably brought about their demise a little sooner. No spray control measures were undertaken due to the annual nature of the measures coupled with the cost.

It should be noted here that the trees could not have been sprayed as they do the crops in the South because it is illegal to apply pesticides aerially in the state of Connecticut.

Before closing, it is important to point out that to let nature take its course in this case is an oxymoron. Someone introduced this insect to the United States from Japan, and nature has as yet no natural enemies for this pest in this part of the world.

LOCAL SOLUTIONS:

CASE STUDIES IN VALUES, CULTURE AND ETHICS IN PRESERVING BIODIVERSITY

Preview of Main Ideas

In order for efforts to preserve biodiversity to be successful, local populations must be included in the decision-making, and their needs and priorities must be considered. Students will explore three case studies of how local peoples in different countries have been included in the process of preserving biodiversity in national parks while preserving their own livelihoods and cultures. Students will then explore a fourth hypothetical case study and develop solutions to the problems stated in the case.

Connections With the Curriculum

Geography, social studies, current events, physical science, and environmental studies.

Teaching Level: Grades 9-12

Geographic Themes: Human-Environmental Interactions (how local peoples view themselves in relation to their environment), Region (how cultural, as well as climatic, economic, geographic/geological factors influence solutions), Place (how sense of place influences solution) and Movement (movement of fauna in and out of national parks, movement of people into area)

Materials

Butcher paper, pens, tape
World Cultures textbook (such as ***Peoples and Cultures***)
Atlases
Reference Map A - World Map (pg. 80)
Reference Map B - Map of Africa (pg. 81)
Reference Map C - Map of Asia (pg. 82)
Reference Map D - Map of South America (pg. 83)
Handout #1 - Royal Chitwan National Park
Handout #2 - South Luangwa National Park
Handout #3 - Central Selva
Handout #4 - Khao Yai National Park
Handout #5 - Research Assignment

Source:

Wells, Michael and Katrina Brandon, **People and Parks: Linking Protected Area Management with Local Communities** (Washington, D.C.: The International Bank for Reconstruction and Development) 1992.

Objectives

Students are expected to:

- Understand that solutions must take into consideration the local culture, traditions, and economic realities.
- Examine how local communities/cultures view themselves and their environment.
- Understand how local peoples value their ecosystem.
- Recognize that local conditions -- topographic, climatic, economic -- impose limits on the types of solutions which are appropriate.
- Analyze three case studies to identify points at which local needs and preservation of biodiversity were brought into harmony.
- Analyze a fourth case.
- Develop a set of solutions to the problems presented in the fourth case..

Suggestions for Teaching the Lesson

OPENING THE LESSON

Introduction:
Discuss the meaning of "biodiversity" if students are not familiar with it. Why is it important? What are some ways we can preserve biodiversity? Lead students into the concept of parks and preserves if they are having trouble.

1. Discuss National Parks in the U.S. and their purpose. How do they serve local people? How do they come into conflict with local people and other interests? Point out to students that conservation efforts in other parts of the world also face problems, some of which are similar and some of which are very different.

2. Have students brainstorm a list of threats to biodiversity in protected areas (the list might include: inadequate management resources (untrained people); human encroachment, change in water regime, poaching, adjacent land development, inappropriate internal development (roads, buildings, etc.), mining and prospecting, livestock conflicts, military activity, forestry activities, removal of vegetation, soil erosion, fire, human harassment of animals). Note these problems on a large sheet of butcher paper and compare with the actual list below:

   A 1985 study of 135 parks in 50 countries reported the most common threats as:

   - illegal removal of animal life
   - lack of management personnel
   - removal of vegetation
   - soil erosion
   - local attitudes
   - conflicting demands on management
   - fire
   - human harassment of animals
   - loss of habitat
   - vegetation trampling

3. Ask students why solutions to the problems of preserving biodiversity need to be local. Discuss the problems which might occur when solutions are imposed from the outside.

4. Tell the students they will investigate three actual cases of developing local solutions to problems of preserving biodiversity.

DEVELOPING THE LESSON

Investigation of Case Studies:
Divide students into three groups. Assign each group one of the case studies (Royal Chitwan, Luangwa-Lupande, Central Selva). Give each group the handout with the case study, the world map, and the appropriate area map (Royal Chitwan - Asia; Luangwa-Lupande - Africa; Central Selva - Latin America).

Give each group Handout #5 (or project it on overhead). Have students work in groups to research the case studies and make class presentations. Presentations must include:

1. Graphic showing LOCATION of case on world map AND on area map.
2. Information on climate, topography of park location.
3. Information on local cultures, including livelihood, language, religion, beliefs about nature, economics, politics.
4. Information on diversity of species within the area of case study.
5. Problems that had to be solved.
6. What agencies were involved in developing solution (local government, national government, international

development agency, private funding, etc.)
7. Solutions and how they are working.

Students should be encouraged to use slides or overhead projector, if available, or other multi-media approaches to illustrate presentation. You may wish to have each group develop a permanent display illustrating their case study. Allow question and answer session with other groups.

CONCLUDING THE LESSON

Hypothetical Case:

1. Have students work in groups (same or new) to investigate fourth "hypothetical" case. Provide Handout #4 - Khao Yai.
2. Extract same information as above (items 1-5 in "Developing the Lesson" section).
3. In groups, have students develop their OWN solutions to problems.
4. Have students present their solutions to class.

EXTENDING THE LESSON

Provide information on actual solution to the Khao Yai case study and compare it with the students' solutions. Have students correspond with agencies monitoring the three actual cases to see how preservation solutions are working.

Teacher Background

Protected areas, such as national parks and wildlife reserves are at the forefront of efforts to preserve biodiversity. Many of these areas around the world are threatened by lack of funding, pressure from human growth and development, and conflicting economic interests. As a result, serious, sometimes violent, conflict between local peoples and their interests and the protected areas have arisen. Various international conservation and development agencies, such as The World Wildlife Fund, The World Bank, the U.S. Agency for International Development, have developed a new set of initiatives known as "integrated conservation-development projects" (ICDPS) to ensure conservation and preservation of biodiversity by recognizing the social and economic needs of the local peoples. Traditional approaches to park management have not been sympathetic to local concerns and have relied upon punitive approaches - armed guards, severe penalties - to exclude local peoples. The ICDPS approach emphasizes the empowerment of local peoples through including them at various levels in decision making and through combining development efforts which improve their living standards with reserve and park management. The case studies presented in the lesson are four of twenty-three such projects which have been studied to assess the success of this approach to management of protected areas. While the researchers have found that the ICDPS approach has resulted in greater economic benefits to local peoples, they have not been able to document a reduction of the pressures and threats to the parks and reserves they are trying to protect.

Solution to Khao Yai:

A village environmental protection society was established in a pilot village, Sup Tai, which provided low interest loans to members of the society in exchange for a promise not to violate park regulations. In addition, project activities have included park trekking for tourists, cooperative stores, community forestry, environmental education, park boundary tree planting, agricultural extension services, and village health volunteers. The project has led to improved relations between villagers and park personnel, although both claim that illegal hunting and timber removal still occur. While the economic benefits of the environmental protection society have been good, they are insufficient to break the hold of the loan sharks.

Caryn White, East Asian Resource & Education Program Director, Yale University

Handout #1 - Local Solutions

Royal Chitwan National Park

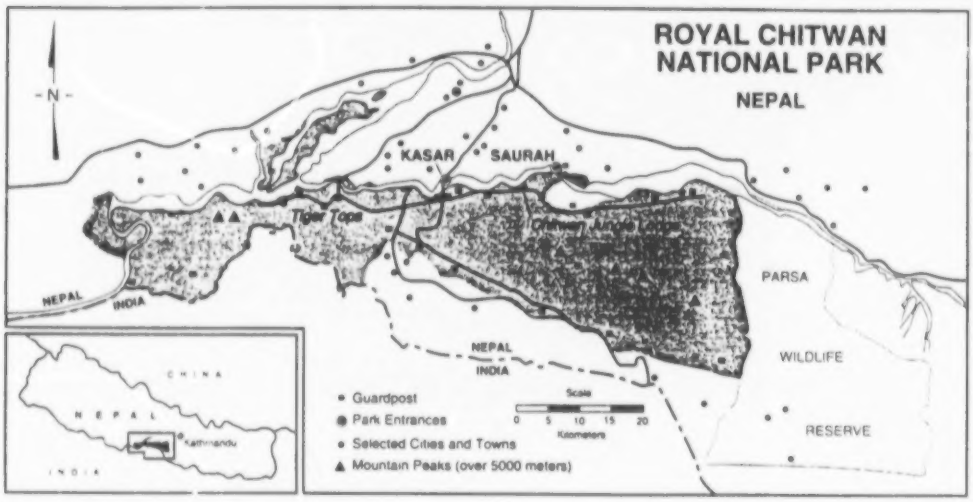
Location: Nepal **Size:** 900 sq. km.
Established: 1846 as a royal hunting area. Became a national park in 1973. Designated as World Heritage Site by UNESCO in 1982.

Flora and fauna: one of last remaining habitats of one-horned rhinoceros and Bengal tiger.

Problems: Area relatively unpopulated until 1950's malaria control opened up plains to agriculture. Population doubled in 1970's. Population continues to grow at 6% per year. Communities lack sources of fuel wood and grazing land. Local people had used park to collect fuel wood, graze livestock, and collect tall grasses. Forced relocation of several villages from inside the park created hostility and mistrust. Further tensions and conflicts have arisen because of prohibitions on grazing and collecting as well as because of human injury and death and livestock and crop loss caused by the large animals in the park. In spite of seven high-cost tourist lodges operating inside the park, tourism has had little local benefit. In fact, local people now face higher prices for basic commodities as a result of tourism. Now protected by 500 armed guards.

ICDPS solution: 100,000 local villagers are permitted to gather tall grass for house construction, roof thatching once a year as the park is the only remaining local source of such flora. However, while the economic benefits top the local villagers of this program have been high, illegal collection of fire wood during grass cutting season equals or exceeds the value of the grass materials removed and poses a threat to the program.

Evaluation of solution: Overall, the park imposes a serious hardship on the local communities. Researchers have concluded that without the presence of the Nepalese army, Chitwan would not have survived to see the present.



Source:
Wells, Michael and Katrina Brandon ***People and Parks: Linking Protected Area Management with Local Communities*** (Washington, DC: The International Bank for Reconstruction and Development) 1992, pp 85-86.

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Handout #2 - Local Solutions

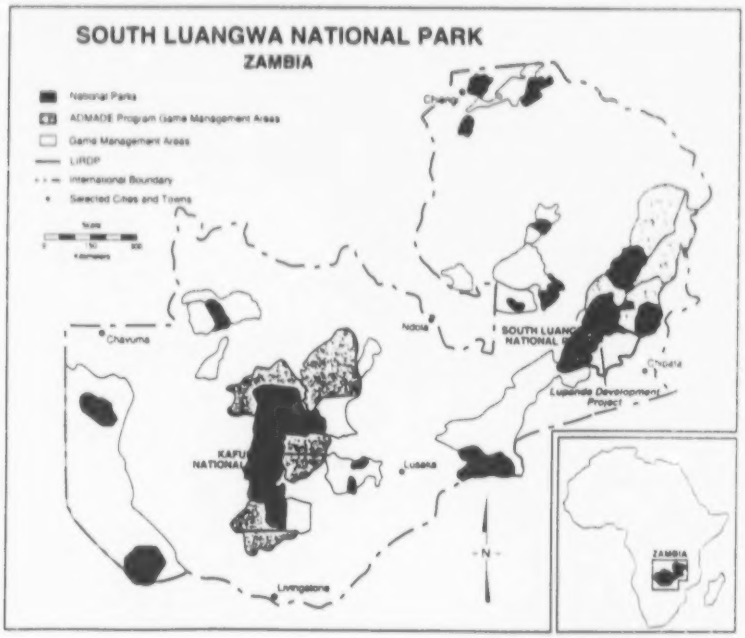
South Luangwa National Park, Lupande Game Management Area

Location: Zambia **Size:** park- 9,050 sq. km. game management ares - 4,840 sq km.
Problems: Economic activity in the Lupande area is limited. Infrastructure is poor, roads are impassable during rainy season, villagers engage in subsistence agriculture. The population in the area totals about 35,000. Poaching of wildlife from the park had been a major threat.

ICDPS solutions: The government of Zambia initiated the project in 1986 to create the Luangwa Integrated Rural Development Project to achieve two goals - the development goal of building better roads and the conservation goal of limiting poaching of wildlife from the park. In addition to building roads which will facilitate antipoaching activities as well as encourage economic development, the government plan calls for hiring 300 game scouts. About 100 of these scouts are to be hired through the village scout program which will provide training, a salary, and equipment. The scouts will participate in antipoaching activity. Another project in the same area, the Lupande Development Project, seeks to return some economic benefit of the wildlife in the park area to the local communities through the creation of a "buffer zone" around the park, the Lupande Game Management Area. Safari hunting is permitted in the game management area. Wildlife harvesting is permitted and the hunting fees for safari activities are returned to the local villages. The revenues from this activity are applied to local development activities at the discretion of the local chiefs.

Agencies Involved: Zambian government; funding from NORAD, the development agency of the Norwegian government. Funding for Lupande Game Management Area is World Wildlife Fund.

Evaluation of Solution: Economic returns as well as higher levels of employment have provided powerful incentives for communities in the Lupande are to value and protect wildlife. Researchers have found strong community support for the village scout program where villagers had previously been hostile to government wildlife management personnel. Evidence also indicates a dramatic decrease in poaching activity in the Lupande Game Management area and South Luangwa National Park.



Source:
Wells, Michael and Katrina Brandon ***People and Parks: Linking Protected Area Management with Local Communities*** (Washington, DC: The International Bank for Reconstruction and Development) 1992, pp. 78-80.

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Handout #3 - Local Solutions

Central Selva Region

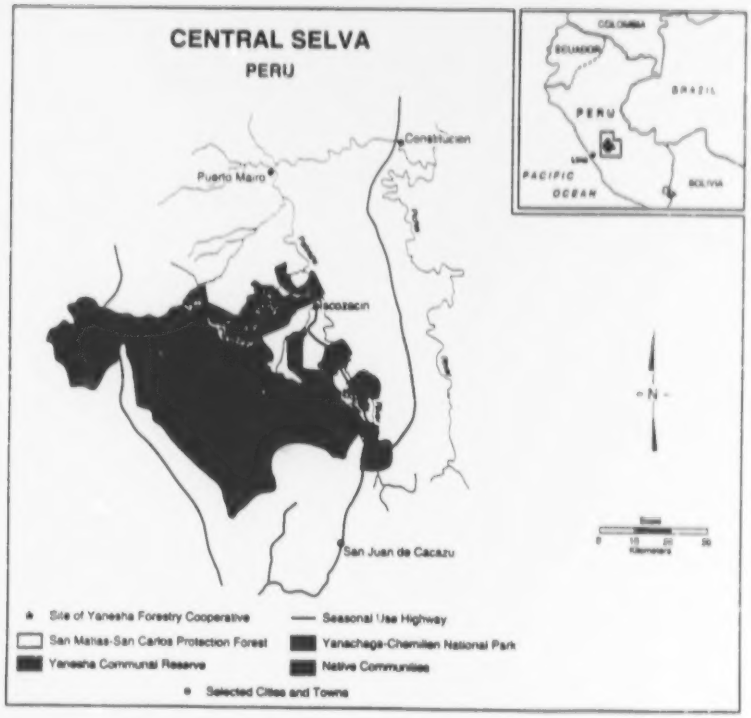
Location: Peru **Size:** 1,220 sq. km park, Yanachaga-Chemillen National Park, other forest and indigenous reserves. Elevations range from 270 - 3,800 meters.

Flora and fauna: Central Amazon rain forest, more than 1000 tree species, countless insect and animal species

Problems: The Central Selva region faces the same problems that threaten rain forest areas worldwide - colonization, agricultural expansion, cattle ranching, logging, mining pollution. In 1980, the President of Peru decided that this region could become Peru's breadbasket through a large scale agricultural development plan.

ICDPS solution: Land-use studies showed that the area was not suitable for large-scale intensive agriculture, that the project would have negative impact on the indigenous peoples of the region - mainly the Amuesha Indians who have been living in the area for more than 1000 years, and an overall negative impact on the ecosystem. The Peruvian government rethought its plans, and instead, decided to support a forest management plan which includes conservation units, agroforestry and local involvement. A cooperative, the Yanesha Forestry Cooperative, was founded by the Amuesha to encourage forest production activities using the strip shelterbelt system. Strip shelterbelts are 20 - 40 meter wide strips which are clear-cut. All cuttings are used: small pieces for fence posts, larger pieces for lumber, scraps for charcoal. Natural regeneration of the strips reclaims the land and maintains species diversity.

Evaluation: While the cooperative and strip shelterbelt system of agroforestry have proved economically beneficial to the indigenous peoples, it has been difficult for researchers to correlate this with a reduction in illegal logging activities in the conservation areas. The project suffered because local communities were not consulted at the beginning of the project, and now suffers because of the severe problem of terrorism in the area.



Source:

Wells, Michael and Katrina Brandon ***People and Parks: Linking Protected Area Management with Local Communities*** (Washington, D.C.: The International Bank for Reconstruction and Development) 1992. pp.39, 95-96.

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Handout #4 - Local Solutions

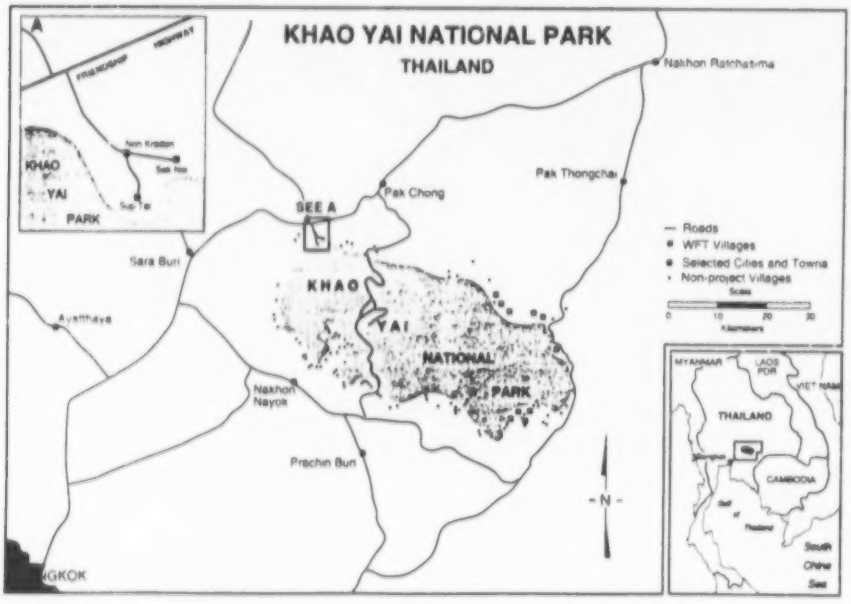
Khao Yai

Location: Thailand **Size:** 2,200 sq. km.

Flora and fauna: Khao Yai has been identified as one of the last remaining viable habitats in Thailand and the highest priority site for plant conservation. It contains exceptionally diverse flora and fauna, including many rare animal species.

Problems: While Khao Yai attracts one-quarter to half a million Thai and foreign visitors per year who spend $4-8 million on admission, lodging fees, transportation, food and other services in the park, conflict with local villagers has been severe and violent. Several armed conflicts have resulted in loss of life on the part of both villagers and park personnel. Some 53,000 people live in 150 villages just outside of the park, many illegally occupying "reserved forest." Poaching, timber removal, and agricultural encroachment continue to threaten the park. Recent investigations have revealed that loan sharks controlled village economies, providing farmers with loans at 5% per month, and then confiscating the land of those unable to repay. This has been identified as the major impediment to resolving the problems around the park.

Your task: Come up with solutions to the problems outlined above.



Source:

Wells, Michael and Katrina Brandon ***People and Parks: Linking Protected Area Management with Local Communities*** (Washington, D.C.: The International Bank for Reconstruction and Development) 1992. pp. 86-88

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Handout #5 - Local Solutions

Research Assignment

1. LOCATE on world map AND on area map site of park.
2. Research climate, topography of park location.
3. Research local culture. Include livelihood, language, religion, beliefs about nature, economics, politics.
4. Research diversity of species within the area of park.
5. List problems between local peoples and park.
6. List agencies were involved in developing solution (local government, national government, international development agency, private funding, etc.).
7. Evaluate solutions.
8. Present alternative solutions you have developed.

SELECTION OF NUCLEAR WASTE DISPOSAL SITES

Preview of Main Ideas

Nuclear waste is an integral part of today's technology. There are positive and negative aspects to the use of nuclear energy. The negative byproduct of nuclear energy is nuclear waste. As of today, the dilemma of longtime safe storage has not been resolved. In this lesson students will become acquainted with what nuclear energy is about, including its positive and negative byproducts. Students will use the Issue Controversy model in which they will assume one of two positions on the issue of a safe nuclear waste site, either locally or abroad, culminating in a large class vote.

Connections With the Curriculum

Social Studies: geography, history, politics, economics, current events
Science: geology
Environmental Studies

Teaching Level: Grades 7-12
Geographic Themes: Location, Place, Human-Environmental Interactions, Movement

Materials

Reference Map A - World Map (pg. 80)
Atlases
VCR
Nuclear Energy: The Question Before Us, *National Geographic* Video
Technology's Price, *National Geographic* Video
Radioactive Waste Management, Northeast Utilities, or other introduction to nuclear energy
State of the Earth Atlas, Map # 19, "The Nuclear Family "and Map #27 "Toxic Trade"
Articles/Information on nuclear waste and criteria used for selecting nuclear waste sites such as
"Ecology's Eastern Front: nuclear waste in the Soviet Union and other countries" by Murray Feshbach, *U.S. News and World Report*, July 20, 1992, page 43.
"The Global Poison Trade: how toxic waste is dumped on the Third World." by Harry Anderson, *Newsweek*, November 7, 1988.
Explanation of "Inquiry Controversy Model Summary"
Egg timer
M & M's candy

Objectives

Students are expected to:

- Understand what nuclear energy is about, including its byproducts.
- Evaluate alternatives for safe, long-term storage here and abroad.
- Understand the interaction between technology and the human/natural environment.
- Learn and appreciate different points of view associated with the use of nuclear energy.
- Recognize the complexity of making decisions.
- Understand the ethics and politics of site selection and in a larger sense, the associated environmental issues.
- Act locally, and think globally.

Suggestions for Teaching the Lesson

OPENING THE LESSON

Introduce the topic of nuclear energy. Student at this age may have strong opinions or ideas on nuclear energy. On individual pieces of paper to be saved, have them write their knowledge, ideas, opinions on nuclear energy,

positive or negative. Have them fold the paper in half and set aside for the end of the activity.

Show a video on nuclear energy. Discuss the issue of disposal of nuclear waste. Explain to students that many poor countries are accepting nuclear waste from developed countries in return for much needed cash. Explain that they will participate in an activity in which they will take the role of a politician in a poor country who wants to help his country develop economically or the role of an international conservationist who opposes the disposal of nuclear waste in such sites.

DEVELOPING THE LESSON

This lesson is based upon the "ISSUE CONTROVERSY" model prepared by K. Michael Hibbard, Ph.D. Assistant Superintendent, Regional School District 15, P.O. Box 395, Middlebury, CT 06762-0395.

1. Have students select M &M's from a covered cup held above their heads (use only yellow and brown). Yellow represents the third world politician who wants to accept nuclear waste, brown represents the international conservationist who is opposed to transshipping of nuclear waste.

   Among those who have selected yellow, divide them into countries which currently accept hazardous wastes from developed countries: There should be two students representing each country.

   China
   Brazil
   Gabon
   Nigeria
   Angola

2. *Partner Pair-Up:* Within each group, students choose a partner and work together as a team to defend their position.

3. *Preparing the Position:* Have students research the policy of accepting waste for the country which they have been assigned. Have them mark on their world maps the location of their countries, also the origin of the nuclear waste their country is receiving (ref: **State of the Earth Atlas**) Have the conservationists research the reasons that they are opposed to the import/export trade in nuclear waste.

   a. To gather information and support materials for their position, students should read newspapers, magazines and watch news on TV. Facts are encouraged but quoted opinions from reliable sources are acceptable. (Note: The teacher can gather information for students and provide them with fact sheets. It depends on the ability of the class.)

   b. After material is gathered, the students organize it into categories and assign it to the individual partners.

   c. Partners write and practice presentation, stating main ideas and details of their positions.

4. *Presenting the Position*

   a. The teacher sets up tables of four with partners facing opponents.

   b. The first team has three minutes to present its position.

   c. While one team presents, the other takes notes; only, no comments.

   d. Take 5-10 minutes to write out questions you want to ask the other group. Each person must contribute at least three questions. Do not ask questions that can be answered with a Yes or a No.

5. *Developing a Perspective*

   a. To develop a perspective, all members at the table must understand both positions.

b. Pros and Cons - each team of students should be provided with a worksheet labeled "Position #1: Information supporting it, and information against it." The same should be done for Position #2. Discuss completed worksheets with group at table.

6. *Reaching a Consensus*

Students on opposing teams at each table must try to reach a consensus. Consensus means the majority of the group will support one of the positions.

a. Write the consensus and list the major reasons why the majority supports that position.

b. Initial your reasons. (Note: If a group cannot reach a consensus, each member must support his/her individual decision.)

CONCLUDING THE LESSON

Final Paper - Each student will write a 1-2 page composition supporting the position he or she finally supported. Each paper must have an introduction, a body of at least three paragraphs which includes supporting facts, and a conclusion.

EXTENDING THE LESSON

Have students write to the various agencies listed below for information on nuclear waste disposal.

Atomic Industrial Forum, Inc.
Public Affairs and Information Program
7101 Wisconsin Avenue
Bethesda, MD 20814-4805

American Nuclear Society
555 North Kensington Avenue
LaGrange Park, IL 60525

Connecticut Hazardous Waste Management Service
Suite 360
900 Asylum Avenue
Hartford, CT 06105-1904
(203) 244-2007

Connecticut Department of Energy
Office of Policy and Management
State of Connecticut
80 Washington Street
Hartford, CT 06106
(203) 566-5770

Connecticut Yankee Energy Information Center
RR #1, Box 127F
East Hampton, CT 06424
(203) 267-9279

Millstone Energy Center
278 Main Street
Niantic, CT 06357
(203) 444-4234

International Atomic Energy Agency
Wagramerstrasse 5, P.O. Box 100
A-1400 Vienna, Austria

World Health Organization
20 Avenue Appia
CH-1211 Geneva 27
Switzerland

International Commission on
Radiological Protection
Clifton Avenue, Sutton
Surrey, England

Mike Nedila and Mary Skelly, Norwich Regional Vocational Technical High School

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International Resources ..... page 79

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Reference Map C - Map of Asia ..... page 82

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Reference Map E - Map of North America ..... page 84

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GEOGRAPHY RESOURCES

National Geographic Society (NGS)
17th and M Streets NW
Washington, DC 20036
1-800-638-4077 (Product Information)

Association of American Geographers (AAG)
1710 - 16th Street NW
Washington, DC 20009
(202) 234-1450

Geographic Educational National
Implementation Project (GENIP)
1710 - 16th Street NW
Washington, DC 20009

National Council for Geographic Education (NCG)
Indiana University of Pennsylvania
Indiana, PA 15705

The Center for Geographic Education
A. David Hill, Dir.
Department of Geography
Box 260, University of Colorado
Boulder, CO 80309
(303) 492-6760

National Council for the Social Studies (NCSS)
3501 Newark Street NW
Washington, DC 20016
(202) 966-7840

Population Reference Bureau
777 - 14th St. NW, Suite 800
Washington, DC 20005
(202) 639-8040

Population Crisis Committee
1120 - 19th St. NW, Suite 550
Washington, DC 20036
(202) 659-1833

World Eagle
64 Washburn Ave.
Wellesley, MA 02181-9990
1-800-634-3805

State of the Earth Atlas
A Concise Survey of the Environment
Through Full-Color International Maps
edited by Joni Seager, Touchstone/
Simon & Schuster (New York) 1990
ISBN 0-671-70524-5

ENVIRONMENTAL RESOURCES

The Children's Rain Forest
P.O. Box 936
Lewiston, ME 04240

Conservation International
1015 18th St., NW, Suite 1000
Washington, DC 20036

Cultural Survival, Inc.
53-A Church Street
Cambridge, MA 02138

Greenpeace
1436 U St., NW
Washington, DC 20009

National Audubon Society
700 Broadway
New York, NY 10010

National Museum of Natural History/
Smithsonian Institution
Washington, DC 20008

National Wildlife Federation
1400 16th St., NW
Washington, DC 20036

National Zoological Society/
Smithsonian Institution
Washington, DC 20008

Natural Resources Defense Council
P.O. Box 1400
Church Hill, MD 21690

The Nature Conservancy
1815 North Lynn Street
Arlington, VA 22209

Rainforest Action Network
301 Broadway, Suite A
San Francisco, CA 94133

Rainforest Alliance
270 Lafayette Street, Suite 512
New York, NY 10012

Sierra Club
730 Polk Street
San Francisco, CA 94109

World Wildlife Fund/Conservation Foundation
1250 24th St., NW
Washington, DC 20037

INTERNATIONAL RESOURCES

Yale Center for International and Area Studies
85 Trumbull Street
New Haven, CT 06520

African Studies Outreach Program
Yale: (203) 432-3436

East Asian Resource & Education Program
Yale: (203) 432-3429

International Studies Outreach Program
Yale: (203) 432-9713

Russian & East European Studies Outreach Program
Yale: (203) 432-3424

SOURCES OF HIGHLY RECOMMENDED K-12 MATERIALS FOR GLOBAL AND INTERNATIONAL STUDIES

The American Forum for Global Education
45 John Street, Suite 908
New York, New York 10038
(212) 732-8606
FAX (212) 791-4132

Center for Teaching International Relations
University of Denver
Denver, Colorado 80208
(303) 871-3106

ERIC/ChESS
2805 East Tenth Street
Social Studies Development Center
Indiana University
Bloomington, Indiana 47405
(812) 335-3838

World Eagle, Inc.
64 Washburn Avenue
Wellesley, MA 02181
(800) 235-3805
(617) 235-1415

Foreign Policy Association
729 Seventh Avenue
New York, New York 10019

Social Science Education Consortium
3300 Mitchell Lane, Suite 240
Boulder, CO 80302
(303) 492-8154

Intercultural Press, Inc.
P.O. Box 700
Yarmouth, ME 04096
(207) 846-5168

Population Crisis Committee
1120 19th Street NW #550
Washington, D.C. 20036
(202) 659-1833

Social Studies School Service
10200 Jefferson Boulevard, Room Y41
P.O. Box 802
Culver City, CA 90232-0802

Stanford Program for International and Cross Cultural Education (S.P.I.C.E.)
5013 Littlefield Center - Room 14
300 Lasuen Street
Stanford University
Stanford, CA 94305-5013

World Awareness. Inc.
890 Twin Towers
Ypsilanti, MI 48198-3882
(313) 481-8860,(800) 472-8860
FAX (313) 481-8860

World Church Service
P.O. Box 968
Elkhart, IN 46515
(219) 264-3102
(CWS hotline 1-800-223-1310 or
NY 1-800-535-2713)

World Bank
Office of the Publishers
1818 H Street, N.W.
Washington, D.C. 20433

Reference Map A
World Map

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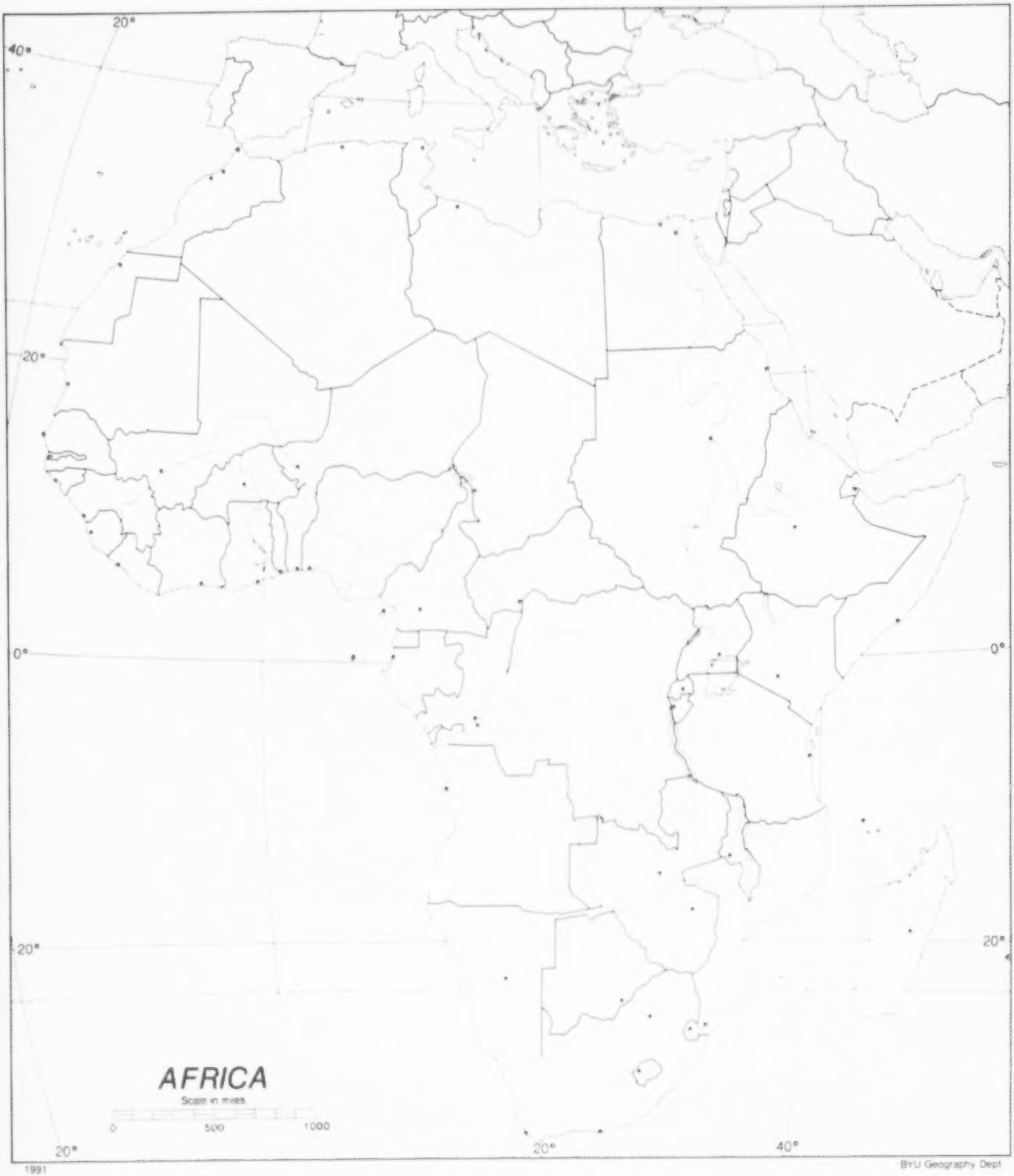
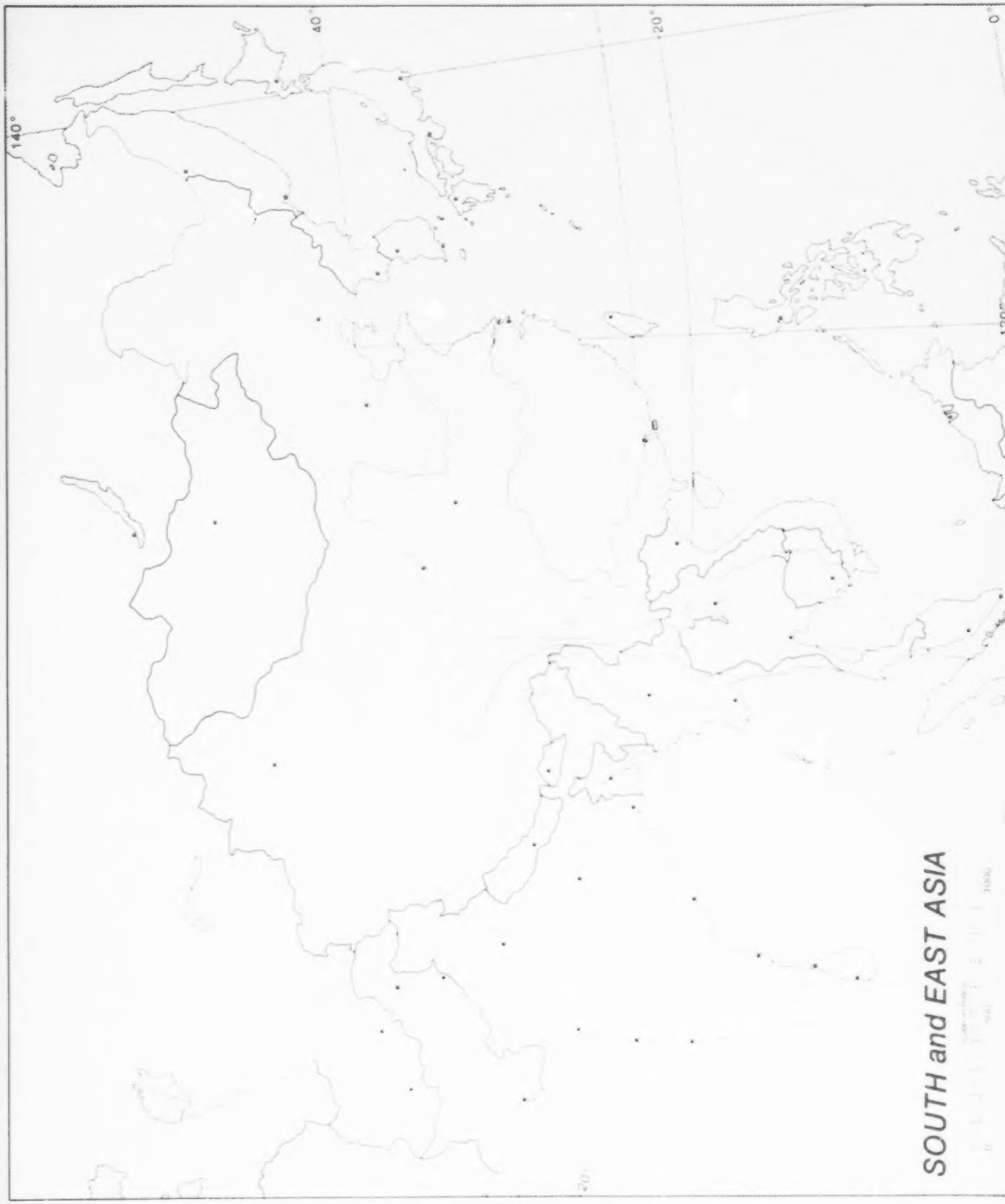
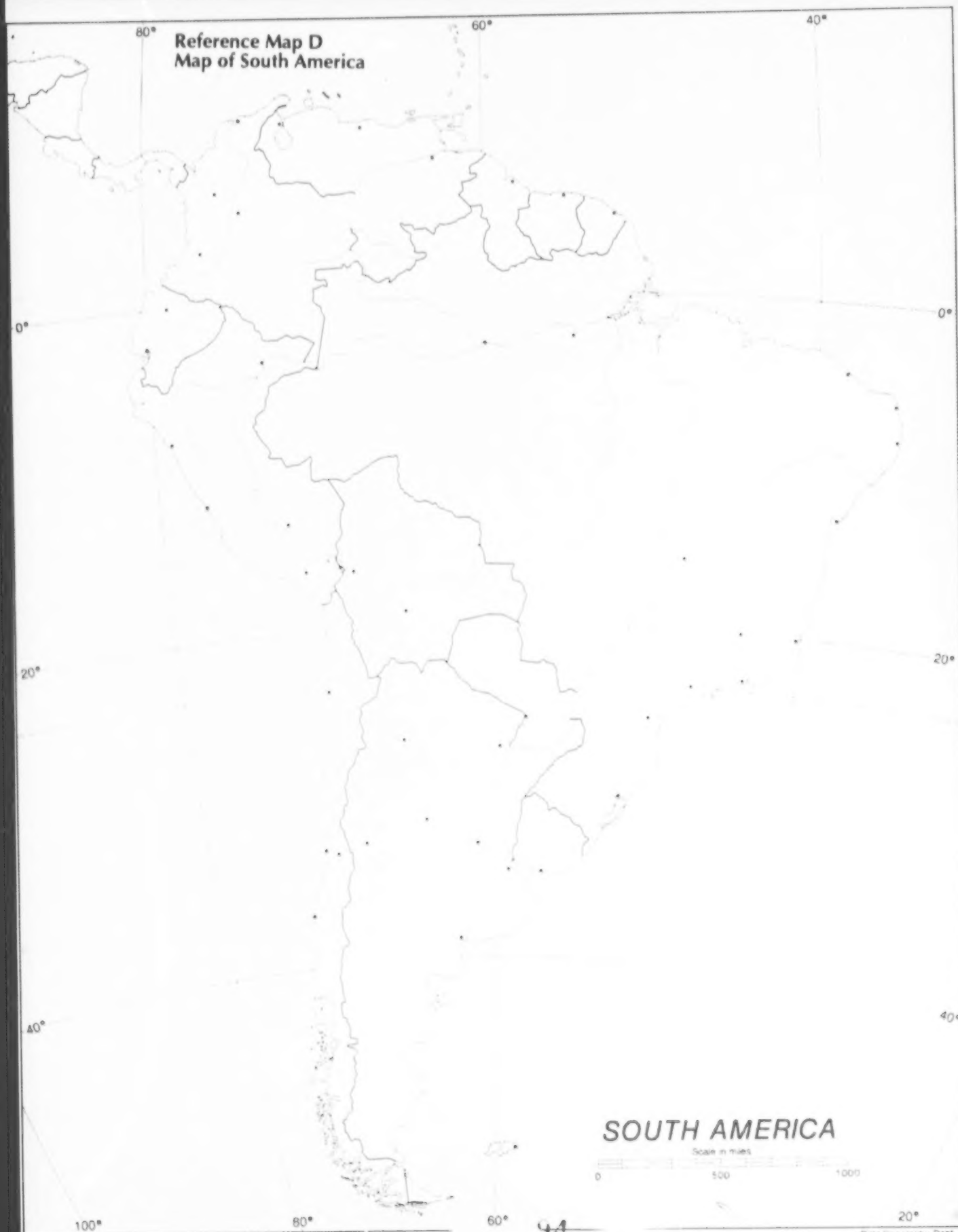
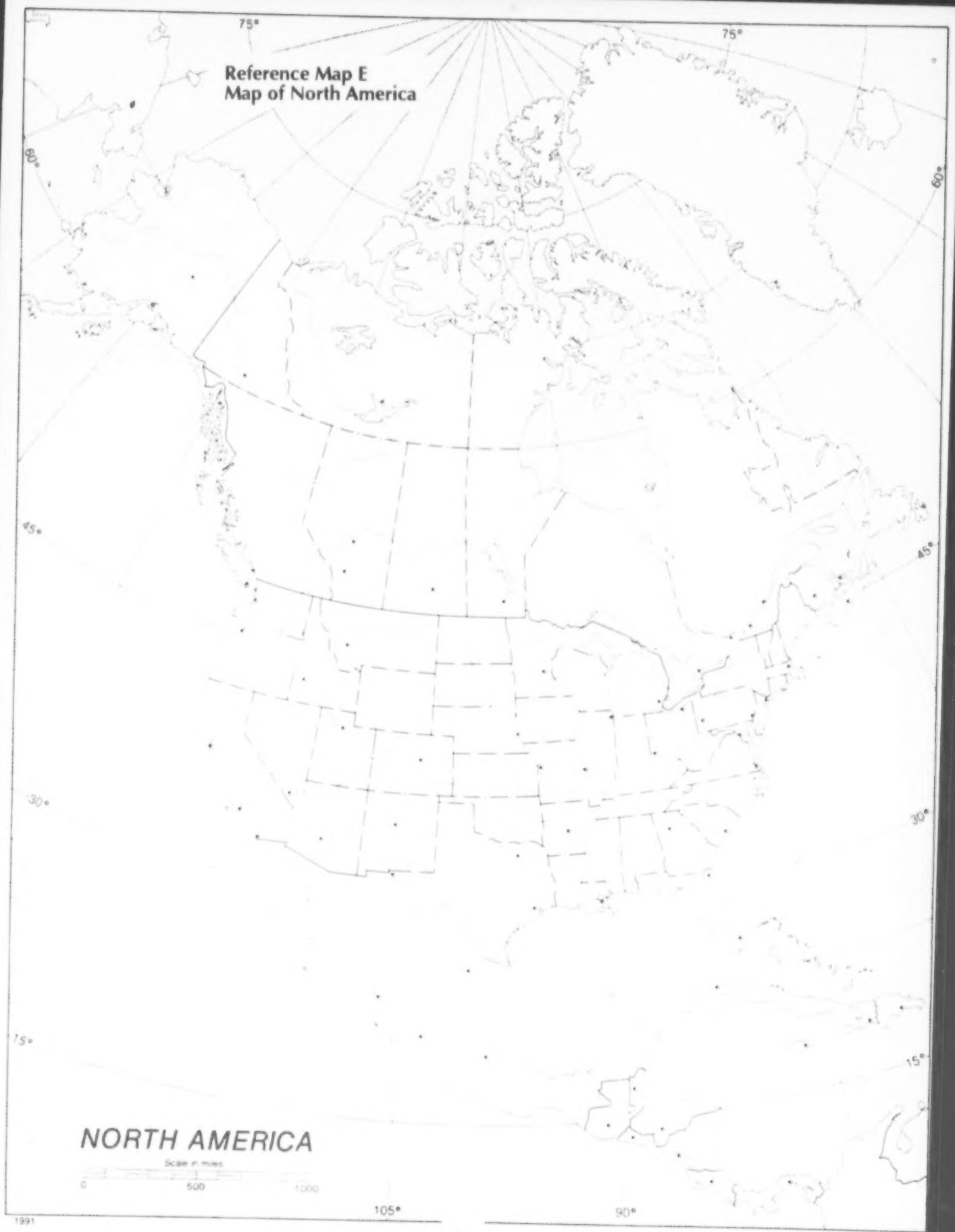
Reference Map B
Map of Africa



Reference Map C
Map of Asia




Reference Map D
Map of South America
80°
60°
40°
0°
20°
40°
100°
80°
60°
20°
SOUTH AMERICA
Scale in miles
0
500
1000
1991
BYU Geography Dept


Reference Map E
Map of North America
75°
75°
60°
60°
45°
45°
30°
30°
15°
15°
NORTH AMERICA
Scale in miles
0
500
1000
105°
90°
1991

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Appendix

The following Appendix contains several data sets abstracted from The World Resource Guide 1992-93 and The World Almanac 1991. The use of data sets such as these can be valuable tools for enhancing the lessons contained in this Teacher's Resource Guide, as well as expanding upon the Five Themes of Geography in the classroom. The data lends itself to (but, is by no means limited to) exercises such as:

1) Location Mapping - ex. countries, volcanoes, and movement patterns of refugees

2) Thematic Mapping - ex. population, population density,population doubling time

3) Comparing/Contrasting regions and nations ex. industrialized/non-industrialized urban/rural

4) Analyzing Relationships - ex. population size, area, and population density

5) Generalizing/Predicting Trends - ex. population growth, decreasing carrying capacity, environmental degradation

SELECTED WORLD REFUGEE SOURCES AND COUNTRIES SOUGHT FOR ASYLUM (1989)

ORIGIN COUNTRY (FROM)	REFUGEE POPULATION	PRIMARY COUNTRIES SOUGHT FOR ASYLUM (TO)
AFGHANISTAN	5,934,500	PAKISTAN, IRAN
PALESTINE	2,340,500	EGYPT
MOZAMBIQUE	1,354,000	TANZANIA, MALAWI, ZIMBABWE, ZAMBIA, S. AFRICA
ETHIOPIA	1,035,900	KENYA, SUDAN, SOMALIA, N. YEMEN
IRAQ	508,200	IRAN
ANGOLA	438,000	NAMIBIA, ZAIRE, ZAMBIA
SUDAN	435,100	UGANDA
CAMBODIA	334,166	VIETNAM, THAILAND, PHILIPPINES
SOMALIA	388,600	ETHIOPIA, DIJIBOUTI
IRAN	270,100	IRAQ
RWANDA	233,000	KENYA, UGANDA, ZAIRE, RWANDA
BURUNDI	186,600	RWANDA, TANZANIA, ZAIRE
VIETNAM	165,000	HONG KONG, MALAYSIA, INDONESIA
TIBET	112,000	INDIA, NEPAL

(Source: adapted from The World Almanac 1991)

SAHELIAN AFRICA: LAND AREA, CROPLAND, AND CLIMATE

COUNTRY	TOTAL LAND AREA (000 hectares)	LAND USED AS CROP LAND	% OF ARID	TOTAL SEMI-ARID	LAND HUMID	COLD
Burkina Faso	27,380	3,564	1	15	84	0
Cape Verde	403	39	100	0	0	0
Chad	125,920	3,205	67	7	27	0
Gambia	1,000	178	0	0	100	0
Guinea-Bissau	2,812	335	0	0	100	0
Mali	122,019	2,093	64	15	21	0
Mauritania	102,522	199	94	5	1	0
Niger	126,670	3,605	86	13	1	0
Senegal	19,253	5,226	7	14	80	0
Dijibouti	2,318	n/a	100	0	0	0
Ethiopia	110,100	13,930	38	16	44	2
Kenya	56,969	2,428	71	14	15	0
Somalia	62,734	1,039	93	7	0	0
Sudan	237,600	12,510	55	11	34	0
Uganda	19,955	6,705	0	5	95	0

(Source: adapted from World Resources 1992-93)

SELECTED VOLCANIC ERUPTIONS 1984-1990 (THE RING OF FIRE)

VOLCANO	LOCATION	LAST ERUPTED	HEIGHT
Lascar (Chile)	23.5 S 68 W	1990	19,652
Sangay (Ecuador)	2 S 78 W	1988	17,159
Klyuchevskaya (Soviet Union)	56 N 160 E	1990	15,584
Sta. Maria (Guatemala)	15 N 92 W	1990	12,400
Irazu (Costa Rica)	10 N 84 W	1988	11,260
Redoubt (Alaska)	61 N 153 W	1990	10,197
Mayon (Philippines)	13 N 124 E	1988	9,991
Shishaldin (Aleutian Is.)	55 N 164 W	1987	9,387
Villarica (Chile)	39 S 72 W	1984	9,318
Ruapehu (New Zealand)	40 S 175 E	1990	9,175
Mt. St. Helens (Washington)	46 N 123 W	1989	8,300+
Asama (Japan)	36 N 138 E	1988	8,300
Bagana (Papua/New Guinea)	6 S 155 E	1989	6,558
Manam (Papua/New Guinea)	5 S 145 E	1990	6,013
Aso (Japan)	33 N 131 E	1990	5,223
Karymsky (Soviet Union)	55 N 160 E	1985	4,869

(Source: Eruption data adapted from The World Almanac 1991)

DEMOGRAPHIC AND AREA DATA FOR SELECTED COUNTRIES

COUNTRY/ 1991 POPULATION (in Millions)	POPULATION DENSITY (per 1000 hectares)	POPULATION DOUBLING TIME (in Years)	% OF POP. LIVING IN URBAN AREAS	% OF LABOR FORCE ENGAGED IN AGRICULTURE
AFRICA				
Algeria 26.6	105	22	51.7	31
Angola 8.9	80	27	28.3	74
Benin 5.0	419	23	37.7	70
Botswana 1.3	23	20	27.5	70
Burkina Faso 9.2	329	25	9.0	87
Burundi 5.9	2133	21	5.5	93
Cameroon 11.4	254	26	41.2	70
Central Afr. Republic 2.9	49	28	46.7	72
Chad 5.1	45	35	29.5	83
Congo 2.4	67	21	40.5	62
Cote d'Ivoire 13.0	377	19	40.4	65
Dijibouti 0.4	176	23	80.7	n/a
Egypt 57.9	527	24	46.7	46
Equatorial Guinea 0.4	125	37	28.7	66
Ethiopia 51.9	447	33	12.9	80
Gabon 1.1	45	36	45.6	75
Gambia, The 0.9	861	28	23.2	84
Ghana 15.5	653	22	33.0	56
Guinea 7.4	234	29	25.6	81
Guinea-Bissau 1.0	343	37	19.8	82
Kenya 26.1	422	17	23.6	81
Lesotho 1.8	585	25	20.2	86
Liberia 2.6	267	22	45.9	74
Libya 4.3	26	22	70.2	18
Madagascar 12.3	206	22	23.8	81
Malawi 9.3	930	21	11.8	83
Mali 9.4	76	24	19.2	86
Mauritania 2.1	20	26	46.8	69
Mauritius 1.1	5849	54	40.5	28
Morocco 27.1	562	27	48.0	46
Mozambique 16.1	200	27	26.8	85
Namibia 1.9	22	22	27.8	n/a
Niger 7.9	61	24	19.5	91
Nigeria 122.1	1192	24	35.2	68
Rwanda 7.5	2934	20	7.7	93
Senegal 7.6	381	27	38.4	81
Sierra Leone 4.3	580	29	32.2	70
Somalia 8.7	120	26	36.4	76
South Africa 40.5	289	27	59.9	17
Sudan 25.9	106	24	22.0	71
Swaziland 0.8	458	21	33.1	74
Tanzania 28.3	308	19	32.8	86
Togo 3.7	649	20	25.7	73
Tunisia 8.3	527	29	54.3	35
Uganda 18.2	942	20	10.4	86

Zaire 37.0	157	23	39.5	72
Zambia 8.8	114	19	49.9	73
Zimbabwe 10.9	251	19	27.6	73
NORTH & CENTRAL AMERICA				
Barbados 0.3	5930	94	44.7	10
Belize 0.2	82	23	n/a	n/a
Canada 26.8	29	92	77.1	5
Costa Rica 3.1	590	28	47.1	31
Cuba 10.7	966	62	74.9	24
Dominican Rep 7.4	1482	28	60.4	46
El Salvador 5.4	2535	26	44.4	43
Guatemala 9.5	848	23	39.4	57
Haiti 6.7	2363	32	28.3	70
Honduras 5.3	459	22	43.7	61
Jamaica 2.6	2268	41	52.3	31
Mexico 91.0	464	29	72.6	37
Nicaragua 3.8	326	20	59.8	47
Panama 2.5	318	20	53.4	32
United States 252.5	272	98	75.0	4
SOUTH AMERICA				
Argentina 32.8	118	51	86.3	13
Bolivia 7.5	67	27	51.2	46
Brazil 153.5	178	34	74.9	31
Chile 13.4	176	43	85.9	17
Colombia 32.5	317	34	70.0	34
Ecuador 11.0	382	27	56.0	39
Guyana 0.8	40	36	34.5	27
Paraguay 4.4	108	24	47.5	49
Peru 22.4	168	33	70.2	40
Suriname 0.4	27	33	47.4	20
Uruguay 3.0	177	83	85.5	16
Venezuala 20.1	224	29	90.5	16
ASIA				
Afghanistan 15.6	254	26	18.2	n/a
Bahrain 0.5	7588	25	82.9	3
Bangladesh 121.3	8880	25	16.4	75
Bhutan 1.6	323	32	5.3	92
Cambodia 7.2	467	31	11.6	n/a
China 1135.5	1221	49	33.4	74
Cyprus 0.7	759	71	52.8	26
India 871.3	2869	32	27.0	70
Indonesia 192.0	1017	35	30.5	57
Iran 57.6	334	20	56.7	36
Iraq 19.5	433	18	71.3	30
Israel 4.8	2263	43	91.6	6
Japan 124.4	3279	141	77.0	11
Jordan 4.3	451	20	68.0	10
North Korea 23.6	1808	29	59.8	43
South Korea 44.2	4334	53	72.0	36
Kuwait 2.2	1144	25	95.6	2
Laos 4.1	179	28	18.6	76
Lebanon 3.4	2640	33	83.7	n/a
Malaysia 18.3	545	28	43.0	42
Mongolia 2.2	14	24	52.3	40

Myanmar 42.7	634	30	24.8	53
Nepal 19.6	1399	28	9.6	93
Oman 1.5	71	21	10.6	50
Pakistan 116.8	1591	24	32.0	55
Philippines 68.6	2093	25	42.6	52
Qatar 0.5	335	25	89.4	3
Saudi Arabia 15.8	66	20	77.3	48
Singapore 2.7	44639	59	100.0	2
Sri Lanka 17.4	2664	43	21.4	53
Syria 13.0	681	18	50.4	32
Thailand 57.4	1090	41	22.6	71
Turkey 57.8	726	32	61.3	58
U. Arab Emir. 1.8	190	30	77.8	5
Viet Nam 70.3	2049	27	21.9	68
Yemen 10.1	472	20	25.1	52
EUROPE				
Albania 3.3	1184	35	35.2	56
Austria 7.6	917	1155	58.4	9
Belgium 9.9	3255	577	96.9	3
Bulgaria 9.0	815	770	67.7	18
Czechslovakia 15.7	1250	301	77.5	13
Denmark 5.1	1214	(-)	87.0	7
Finland 5.0	163	277	59.7	12
France 56.6	1021	161	74.3	9
West Germany 61.4	2510	(-)	87.4	6
East Germany 16.6	1545	990	77.2	11
Greece 10.1	768	630	62.5	31
Hungary 10.5	1143	(-)	61.3	18
Iceland 0.3	25	69	90.5	10
Ireland 3.6	540	89	57.1	19
Italy 57.6	1940	2310	68.9	12
Luxembourg 0.4	1448	1155	84.2	5
Malta 0.4	11031	99	87.3	5
Netherlands 15.0	4408	158	88.5	6
Norway 4.2	137	315	75.0	8
Poland 38.6	1262	114	61.8	29
Portugal 10.5	1119	257	33.6	26
Romania 23.4	1010	141	52.7	31
Spain 39.5	785	210	78.4	17
Sweden 8.5	205	367	84.0	6
Switzerland 6.6	1662	267	59.9	6
United Kingdom 57.5	2369	289	89.1	3
Yugoslovia 24.0	932	114	56.1	32
U.S.S.R. 294.5	130	70	65.8	20
OCEANIA				
Australia 17.1	22	88	85.5	7
Fiji 0.8	418	31	39.3	46
New Zealand 3.4	127	83	84.0	11
Papua/N. Guin 4.1	86	26	15.8	76

(Source: adapted from World Resources 1992-93)

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